FLORA MALESIANA

SERIES I - SPERMATOPHYTA

Flowering Plants

Vol. 7, part 4

Dedication – Revisions
Addenda – Index

INDEX TO REVISED FAMILIES

TAXONOMICAL REVISIONS

ISBN 90 286 0615 7

PUBLICATION DATES
Part 1 26 Jan. 1972
Part 2 12 Jan. 1973
Part 3 13 Sept. 1974
Part 4 24 June 1975

Printed in the Netherlands

CONTENTS

TAXONOMICAL REVISIONS

in alphabetical sequence

ADDENDA

to volumes 4, 5, 6, and 7

INDEX

Dedicated to
HERMAN JOHANNES LAM

DEDICATION

The completion of the seventh volume of this Flora gives me the occasion to dedicate this volume to HERMAN JOHANNES LAM, who from the beginning was intimately connected with the taxonomical study of the flora of the Malesian region, adopted the working team, provided for it a permanent niche in his institute, and finally played an important role when the perpetuating of its existence was threatened in 1958.

HERMAN LAM was born in Veendam, January 3rd, 1892. His father was an organic chemist and taught chemistry at Veendam. There was a possibility that he would be attached to the University at Groningen, but he accepted a new post in Rotterdam, in 1893, to set up the first municipal food-inspection department in Holland; this stood model for such inspections annex laboratories in other places. He also had a major share in the realisation of the Dutch 'Codex alimentarius'.

Thus, it was at Rotterdam that HERMAN grew up and received a 'classical' education at the 'Gymnasium Erasmianum' (1904–1911). Though he did not have an enthusiastic teacher he decided to study natural history, at his father's suggestion at the University of Utrecht.

This study lasted from 1911–1919. Just before the first World War (1914–1918) he managed to get his B.Sc., but during this war he was in military service part of each year. During the winter months he was allowed to pursue his academic studies, thanks to the support of his biology professors. It was quite an achievement to have this study crowned by a thick thesis (April 7th, 1919) within eight years under these difficult circumstances, as such would be the least required in peace-time. From this it can be deduced that HERMAN was an eager, devoted, and zealous personality, and during all his life he came up to this mark. In biology he felt not attracted or fit to devote his research to experimental work, and so his principal teacher became professor A. A. PULLE. As he had himself ideas to make a career in the tropics he got a training in acquiring form knowledge with plants of Surinam. PULLE, who tried to promote taxonomy of tropical plants at Utrecht, then the only centre in Holland where this was initiated, selected for him the family *Verbenaceae* of the Netherlands Indies, as LAM had in view to make a career there.

The thesis was entitled: 'The Verbenaceae of the Malayan Archipelago, together with those of the Malayan Peninsula, the Philippines, the Bismarck Archipelago, and the Palau, Marianne and Caroline Islands'. With these extensions beyond the boundaries of the former Netherlands Indies proper, he set a geographical standard delimitation which closely approaches the area covered by Flora Malesiana. Owing to the restricted wartime communications his voluminous thesis could only be based upon the materials in the herbaria of Utrecht, Leyden, and Berlin-Dahlem, without access to those at Kew and especially those at Bogor. In the brief chapter on plant geography he showed his interest in chorology and dispersal and the probable genesis of ranges. This was also reflected in the attached 'Stellingen' (theorems) on the Philippines as an area of junction of dispersal lines of *Verbenaceae*, origin and dispersal of *Cocos* and his defence of the then recently posed theory on continental drift by WEGENER (1917), then a novel and rather wild idea, on which he had to give a colloquium for his professor NIERSTRASZ. This just fitted him, as LAM felt always attracted by new ideas and theories. In the brief chapter on taxonomy he paid attention to affinities of genera, their place in the system, and derivation from others. This, again, is stressed in the 'Stellingen' where he posed an assumed polyphyletic derivation of *Geunsia* from *Callicarpa*[1], and, furthermore, he made a plea for biosystematics and delimitation of taxa by means of incompatibility. In both fields he was obviously led to

(1) This was premature jumping to conclusions. The disentangling of the *Callicarpa-Geunsia* complex is not yet solved and will require a great deal of detailed routine research, as I have recently pointed out.

deductions and theoretical reasoning. This characteristic facet of his scientific ambition, to synthesize main issues in addition to collecting factual material, was possibly to a certain degree due to his professor in zoology, H. F. NIERSTRASZ, to whom he referred in the preface of his thesis, and whose teachings had awakened in his mind a latent predilection for theorizing.

In one of the theorems he advanced, he mentioned with satisfaction that the Utrecht student corporation, 'Het Utrechtsch Studentencorps', showed a softening of its rigid traditions which he considered a sign of progress; this reflected an open, progressive state of mind.

I have dealt with this period and his thesis rather in detail because taken together they reflect in a nutshell LAM's scientific ambitions while allowing glimpses of his personality, and experience has taught that these hardly ever change after one has reached submature age.

In 1919 two positions were vacant for a botanical career in the Netherlands Indies, one at the rubber and coffee experiment station at Djember and one at the Herbarium of the Botanic Gardens at Buitenzorg (Bogor). He chose the latter and was appointed botanist in this institution, a division of the famous 's-Lands Plantentuin, mecca of tropical botany.

After having settled there in the same year, it appeared to his, not altogether agreeable, surprise that during 1917–1918, when, because of war conditions, communication between Holland and its overseas colony had been extremely difficult, Mr R. C. BAKHUIZEN VAN DEN BRINK had also and simultaneously prepared a MS-revision of the Verbenaceae, based on the Bogor material. These two treatises, of course, did not tally. Rather under pressure, this awkward situation led to the undertaking of a new revision of Malesian *Verbenaceae* which they performed together, dividing the genera between them. This paper was conceived in rather great haste; for brevity's sake descriptions were omitted, and it is found to be not very useful. It shows quite some deficiencies and proofs were badly corrected during LAM's absence in New Guinea. Also I have the impression that LAM did not perform his treatments with much enthusiasm and that he was more or less bored with this, what he called a rather dull and 'characterless' family, which gave him little synthetic satisfaction.

During this initial period at Bogor he tried, partly during holidays, to familiarize himself with the Javanese flora and he climbed several mountains. He gave accounts of most of these trips by publishing a small readable essay in 'De Tropische Natuur', the semi-popular journal of the Natural History Society in the Netherlands Indies. This he did also on certain shorter trips and it often appears that his is the only botanical information on such spots.

Then came soon the great opportunity to join a really large multidisciplinary expedition to Dutch New Guinea, led by staff-captain A. J. A. VAN OVEREEM, June 1920–January 1921. This was an immense experience, the manual work being facilitated by his able assistant, mantri AJOEB. The immense Papuan land caught his fancy for ever and besides the collecting work he paid full attention to all sorts of ecological observations and to the agricultural methods of the mountain Papuans. He made unique collections on the summit of Mt Doorman, a massif isolated from the Main Range, the only ones ever made. His experiences he laid down in a series of interesting and well-written papers, under the general title 'Fragmenta Papuana' (1927–1929) of which two decades later Miss L. M. PERRY, at Harvard, published an abbreviated version in English in 'Sargentia'.

Subsequently LAM's official work in the Bogor Herbarium was focussed on giving an account of the family *Sapotaceae* in the general scheme of the series 'Contributions à l'étude de la flore des Indes Néerlandaises'. This scheme was set up between the Botanic Gardens and the Forestry Experiment Station at Bogor by which the Herbarium should give priority of revisions to 'useful' families, yielding important timbers or other forest products. This knowledge was in turn of importance to the Museum of Economic Botany of which the chief, K. HEYNE, was engaged to

compose the 2nd edition of his 'Nuttige Planten van Nederlandsch Indië' (published 1927), up to now the standard work on this matter.

The revision of this large, and taxonomically difficult family *Sapotaceae* was published in 1925. Systematically LAM found it a 'rebellious' family, and undisciplined by its abundant reticulated connections of characters, resisting satisfactory efforts towards its revision. It led him to a study of geographical subdivisions and demarcation lines within Malesia published in 1927; in this he tried to reconstruct the pathways along which Sapotaceae had distributed in Malesia.

As a pastime he continued to think about genetic plant-geography and composed a paper (1930) on Wegener's continental drift theory in relation to Malesian plant-geography, stimulated by IRMSCHER's work on the same subject, which he fully supported. This paper, however, was in fact largely a review of the general geophysical theory, but not based on an analysis of the plant-geography, living and fossil, of Malesia.

End 1923 LAM agreed to act as general secretary of the 3rd Netherlands Indian Congress of Natural Sciences which took place at Bogor, 25–28 September 1924. These congresses, organised at intervals of 3–4 years, were fairly large events, and required efficient preparation and administration. As its general secretary LAM had to report and was also responsible for the publication of the Proceedings ('Handelingen') which appeared mid-1925. The diligent way in which he smoothed the way of this congress and its Proceedings was probably the reason why later he was entrusted with the same position for the much bigger 4th Pacific Science Congress in 1929.

In 1925 E. D. MERRILL, who had then just left Manila and had always been very much interested in the plant-geographical division of Malesia, especially its central part 'Wallacea', suggested to the then director of the Botanic Gardens, professor Dr W. M. DOCTERS VAN LEEUWEN, that a closer study should be made on the phytogeographical connections of the Philippines with the adjacent parts of the Netherlands Indies. DOCTERS VAN LEEUWEN, who was always enthusiastic to favour explorations by his younger staff members, accepted this project and paved LAM's way to make another large expedition, lasting three months, to northeast Celebes and the northern Moluccas: Talaud Is., Karakelong, Miangas, and northern Moluccas (Morotai, Ternate, and Tidore). In agreement with the Bogor strategy or policy of taxonomical research, these collections, as well as those from his earlier New Guinea expedition, were filed to be worked out by specialists, instead of having them hurriedly and uncritically worked out and published separately, the strategy followed by MERRILL in the Philippines and RIDLEY in Malaya, and from which so many hurriedly conceived superfluous names emanated. Much later the results of this expedition were mostly worked out at leisure during World War II (together with his student Mr L. B. HOLTHUIS) in two large papers (1942, 1945), followed by a sketch of the plant-geography of Celebes (1945).

After his successful expedition to 'Wallacea' in 1926 LAM became engaged in the revision of another important tree family, *Burseraceae*. This he found a family to his taste, 'entirely disciplined, well-bred, you could almost say civilized', yet not dull, but showing a limited number of interesting problems, some of which he tackled and solved to his satisfaction and that of others. It led him to a new system of part of the family, but also to the study of comparative morphology and phylogenetic hypothesis in conjunction with taxonomy and plant-geographic speculation. After some precursory studies the final revision was published several years later, in 1932.

In this study he believed to have detected real phylogenetic (evolutionary) lines. This stimulated him, as he said, towards phylogenetic problems. But at the same time he began to feel

uneasy, 'as everybody who is familiar with this matter will realize how difficult it is to discriminate in such cases, between various degrees of probability, and how easy it is to be carried along by the conclusion most alluring to yourself, on whatever account.' He felt himself on slippery ground, and this confused his mind, making him doubt the value and rigidness of scientific achievements and truths. This confusion, he told me, was strengthened when he read HAYATA's 'Dynamic System' and, impulsive and romantic as he was, it appealed to him and he wrote a paper (1936) 'on the various types and methods to express or figure phylogenetic trees, and use phylogenetic symbols, testing as it were their scientific value'. Amongst others he introduced the phylogenetic concept of the 'genorheithrum' (1938). At the same time W. ZIMMERMANN's book on phylogeny of plant life (1930) stimulated him still more towards phylogenetic speculation, but doubt about the scientific value of these speculations gradually undermined his self-confidence to no mean degree, he told me recently, and led him towards thought about the real powers and limits of science and religion. Obviously he really suffered from this doubt and was always nagged by his conscience by treading on hypothetical terrain. Through his emotional nature he felt it more deeply than others.

I have inserted this digression at his special request because his mental difficulties started with the conclusion of his revision of the *Burseraceae*. I extracted it from a larger MS note.

The delay in the publication of this work on *Burseraceae* was partly caused by his appointment as general secretary of the 4th Pacific Science Congress, a mighty and most successful enterprise, centered in 1929 at Batavia (Jakarta) and Bandung. The preparation of this large event occupied most of his time for almost two years; it showed his excellent capacity of efficient organisation. This was officially recognized by the Dutch Government by his nomination to 'Officer of the Order of Oranje Nassau'.

In these years he was also secretary of the Netherlands Indian Society of Nature Preservation which was successfully rehabilitated by him and his friend Dr K. W. DAMMERMAN, chief of the Zoological Museum at Bogor.

During the world-wide economic slump set in with the thirties, severe reduction and reorganisation of the staff of the Gardens led to his appointment as chief of the Treub Laboratory at Bogor in 1932, while he simultaneously succeeded the retired director of the Gardens, Prof. Dr W. M. DOCTERS VAN LEEUWEN as extra-ordinary professor of botany at the Medical School at Batavia (Jakarta).

This was soon followed, in 1933, by his appointment as director of the Rijksherbarium and extra-ordinary professor of plant taxonomy and geography at the University of Leyden. This brought his fourteen years of tropical career to a close, but of course did not dim his interest in tropical botany. At Leyden, activities in connection with tropical plants had, since MIQUEL's death in 1870, been in a deep slumber — apart from BOERLAGE's interest — a most regrettable lapse of over 60 years after the preceding BLUME-MIQUEL period from 1829–1870, when tropical botany had been the main task of the Rijksherbarium.

With great energy LAM engaged himself to revive Malesian botany, starting with a minute staff. In 1934, one year after his appointment, he erected a new journal 'Blumea' to replace the earlier 'Mededelingen', focussed interest on New Guinea botany, attracted students and colleagues to work on Malesian botany, and succeeded in slowly building up a larger staff, whom he tried to stimulate towards contributing revisions of tropical plants. He also emphasized the necessity, or at least desirability, of botanists making at least one large expedition to the tropics, which from his own experience he regarded as a major means of confrontation, not so much for pure collecting alone, but for the widening of the interest and horizon of the student, and his personal development, in that he was faced with all sorts of facets of life, from organising

trips to packing material, recruting native helpers, and bargaining about prices of transport, but also spotting desirable plants in the field and gaining experience with tropical plants, their variability, way of habit and habitat, and thinking about their possible origin. Making such expeditions has become a tradition at the Rijksherbarium since LAM took the helm. As a matter of fact it had been proposed long before, by MELCHIOR TREUB, for students of all branches of botany.

Being himself a pur sang individualist, he always left students freedom, had an open mind for suggestions, and allowed them to follow their predilection. Thus he also built up a division for algology, with the help of Miss Dr J. TH. KOSTER. This division became opportune after the donation of Mrs WEBER-VAN BOSSE's very large collection of Algae, and also a division of Fungi, which properly started when Dr MAAS GEESTERANUS wanted to specialize in Lichens. Rather sensitive to appreciation, LAM guided the staff as an enlightened autocrat, who took great care in maintaining most pleasant mutual relationships, thus creating an atmosphere of intimacy and appreciation: everybody knew that the boss was personally interested in him or her; often he invited staff members at his home. He always had patience to listen to arguments and weigh them; he wanted people to be straight and open, to make proposals and to defend them, and to expose freely their aims and desires. This sometimes tended to be somewhat difficult for shy persons, whom he tried to stimulate by making provocative remarks, no doubt having in mind to contribute in this way to overcome their shyness and develop their individuality. He always thinks in relative, shaded terms, adhering to the philosophy of 'omnia dubia', being not shy to throw his own opinions to the wolves and having a laugh at himself. Through his sensitivity he felt often more or less attracted by the lame duck and tried to shield the underdog.

This agreeable atmosphere was in my opinion one of the greatest human assets of his leadership; it stimulated work in no mean degree. We still harvest the benefit of it, even now that the staff has so much increased, which necessarily leads towards slackening of personal relationships. There is now an internal 'staff society' which organises festivities, and through which even the once famous Santa Klaus feast survives, be it only for children and grandchildren and without the superb rhymes of which LAM had the monopoly. LAM used to receive staff members on the first of January at his home; at present this reception is given by the director in the spacious canteen which is then for a few hours wet for the occasion.

Before World War II, and still more after it, LAM was much occupied with organising and administration, lecturing and teaching, practical courses, excursions, he had to set up from scratch. This lamed his personal research: it became so to speak embodied in the output of his students and promovendi which he charged with new revisions of the families which he worked on himself earlier: chiefly *Burseraceae* and *Sapotaceae*.

In passing, it should be realized that his own attempts, and those of others, at making (subfinal) revisions of Malesian plant families at Bogor in the twenties had been premature, largely due to inadequacy of available collections, as well as to insufficient contact with and benefit of the large European taxonomic centres. Even now, after the tremendous influx of collections in the past forty years, the riches of the Malesian flora are by no means exhausted and new species, even new genera or records of these appear each year. We assume that the bulk of the flora is now represented in herbaria, but high priority for exploring 'under-collected' islands has become urgent because the destruction of the virgin flora increases at an alarming rate.

At the end of the thirties a plan was made among Dutch professors and professional botanists to make a joint tour through South Africa. LAM decided to participate, but also to use the occasion to attach to it a collecting expedition to the Mascarenes and Madagascar, during which he was accompanied by his assistant Mr A. D. J. MEEUSE, now professor of botany at Amsterdam.

In 1939 he attended the Pacific Science Congress at Berkeley where he suggested the publication of plant maps of Pacific plants; long afterwards I could realize the publication of 'Pacific Plant Areas' of which now 3 volumes have been published.

Only during the war LAM could perform some taxonomic research work, mainly on his former collections, but since then he occupied himself largely with theoretical botany on phylogeny of *Cormophyta* including the fossil record, in conjunction with ideas about morphological derivations. This interest led, amongst others, to the appointment of W. A. VAN HEEL as plant morphologist. These morphological considerations held his full attention; he was especially interested in the telome theory, and in the concepts stachyospory and phyllospory in *Cormophyta*, in the frame of phylogenetic thinking. LAM liked concepts, and by the way, introduced the term 'taxon', now in universal use for taxonomic entity.

Since his work with the *Burseraceae* phylogeny, in conjunction with morphological derivation on the basis of typology (primitive to advanced, homology and analogy), palaeontology and plant-geography had occupied him deeply and he made it also the subject of his inaugural lectures at Batavia in 1932 and Leyden in 1933, as well as of his oration as a Rector Magnificus of the University (1959). In his 'Tradenda' he wrote that he had often experienced that his interest and way of thinking agreed more with that of historians and comparative linguists than with that of many a biologist.

When World War II broke out in 1940 LAM realized that this might threaten the lifelong effort of Dr C. A. BACKER, whose voluminous MSS on the Flora of Java existed as a single copy and were in the private possession of the author. Dr BACKER agreed that its safeguarding should be managed by the Rijksherbarium through multiplication by stencil. Of this so-called 'Nooduitgave' (emergency edition) of the Flora of Java the first part appeared already in November 1940; it was printed in 25 copies. As BACKER had not finished all families LAM also had to attract temporary collaborators (mainly Mr A. G. L. ADELBERT and Dr R. C. BAKHUIZEN VAN DEN BRINK Jr) to complete this first Dutch version. Much later he also succeeded to have the completed Flora of Java translated into English and attract funds to have this standard work printed in its final form.

During the war when many plans for the future were designed LAM, LANJOUW and others contemplated a taxonomical counterpart of REINDERS & KONINGSBERGER's textbook of general botany. With the closing of Leyden University during the occupation, in 1942, LAM resigned as professor and director. During this time he spent much time in drawing chapters for this textbook, but abandoned this effort as soon as the University was re-opened on May 5th, 1945, and he was re-appointed in his positions. The textbook was never completed; small parts of his MSS were incorporated in botanical chapters of a new Dutch systematical encyclopaedia, 'E.N.S.I.E.'.

In post-war years LAM made two larger tours abroad, both connected with the tropics. In 1949 he attended officially the 7th Pacific Science Congress in New Zealand, travelling there via North America and the Pacific Islands. In 1954 he was away from June to October, to attend officially the 2nd Pan Indian Ocean Congress at Perth. Here he was awarded a honorary doctorate; going by boat and returning by plane he was able to visit and collect in Ceylon, Australia, New Guinea, Manila, and Bangkok.

As mentioned before, New Guinea, the site of his first large expedition, and really a dorado for the botanist, held his fascination. In the fifties LAM was the driving force of an attempt towards organizing a large multidisciplinary expedition, equipped with modern means of transport. The main purpose was exploring the Dutch, western part of the Star Mountains, in Central New Guinea, near the frontier with the Territories of Papua and New Guinea; it lasted from March to September 1959. Owing to some bad luck but largely through inefficient organi-

sation, the botanical results were less than expected. The word 'multidisciplinary' sounds promising, but such large-scale undertakings are clumsy affairs now out of date, and small one--purpose expeditions which are far cheaper and more efficient should be preferred.

Besides building up the Herbarium and its international reputation, looking for ways to increase collections especially of the eastern tropics, attempting to increase staff for new projects or strengthening existing ones, LAM ran into serious difficulties with the available working space in the building. On two occasions in the fifties he was offered a temporary new abode in an abandoned factory in the town of Leyden. Partly because of insufficient safety against fire and partly because of the undesirability of then becoming separated from the Hortus and annex botanical laboratories, he declined these offers.

This lack of space was to quite some degree caused by the fact that he had granted working space to the team of the Foundation Flora Malesiana which had grown to a force of six persons. When by December 1957 the financial basis, from Indonesian source, fell away under this Foundation, and no other international support appeared to be available, LAM very strongly supported my plea to Leyden University to keep the team intact. With the intermediary of the 'Netherlands Foundation for Pure Scientific Research (Z.W.O.)' the University agreed to adopt this team and in the course of three years incorporated it in the staff of the Rijksherbarium. By this most fortunate decision the working scheme of Flora Malesiana became the official project of the tropical division of the Rijksherbarium, a most important achievement for this division which now got manpower and definite purpose. We cannot be too thankful for LAM's loyal and wise support.

It did not solve his space problem, however, and finally he gave in when the University proposed to accommodate four University institutes — among which the Rijksherbarium — in a 'Provisorium' for which the wool and stocking factory of PARMENTIER on the Schelpenkade 6, situated at a few minutes on foot from the old site, would be purchased and accommodated. He realized that this was the only, opportune solution to his space problem, the main worry being for him, and for me, that it was not fully fire-proof. As his successor it fell to my task to realize this accommodation. It would give opportunity for expansion of tasks and more efficient work for the staff, especially the technical staff. Moreover, it was intended to serve for only ten years; in 1970 it was envisaged in the then University planning that a permanent, fully fire-proof 'Rijksherbarium definitivum' would be built outside the town near the new Hortus. I must confess that, personally, I mistrusted this rosy perspective, and was not surprised when preparations for the planning of this new building were very soon abandoned.

I should not omit to mention that LAM's ideas about the organisation of taxonomic research work in the Netherlands had been quite different in the late forties. Shortly after the war, in 1947, there was a special meeting of the Netherlands Botanical Society, held at Utrecht, in which LAM made a strong plea for a 'Central Research Institute for Taxonomic Botany', not necessarily at Leyden. This would be affiliated with all Dutch Universities in such a way that all students in biology would get a primary training for their B.Sc. in their own University, but would receive research subjects and training for their M.Sc. or Ph.D. at the Central Institute. This ideal of his did not meet with the unanimous approval which was compulsory for success to approach the Government. I believe he always regretted this, but accepted the alternative principle that there would be no competition or overlapping between the taxonomic centres in the Netherlands, of which there are now three main ones: Leyden for the East, Wageningen for Africa, and Utrecht for the Neotropics. After all, I believe he will now realize that the alternative idea has worked out very well indeed and that its acceptance need not to be regretted.

The last years of LAM being in office took a large toll of his energy as he spent two years on

administrative and representative work for the University, first as Secretary to the Senate, followed by a year as Rector Magnificus, during which years he had to delegate part of his lecturing to younger staff members. The last years of his tenure were unfortunately darkened by a prolonged severe illness of Mrs LAM and a decline of his own physical condition.

During these years his many activities had led him to live more or less above his physical capacity and, though he was given all facilities after his retirement, he understandably enough did not immediately make the effort to take up personal research work of his fancy.

After having finished the printed version of his valedictory lecture 'Tradenda. Mijmeringen bij een afscheid' (June 1962), he set up a 'Rijksherbarium Foundation Professor Lam', starting himself with a modest grant and inviting other botanists to contribute a yearly donation. This Foundation, which is administered by the University, serves for purposes of importance to the Rijksherbarium. As yet it remained a small Fund and has been used to stimulate students: each two years a prize is awarded to the graduate student who has, during the intervening period, performed the best subject study for his doctoral examination. The prize is a large paper-weight in the shape of a lamb, in bronze, with inscription.

We are happy LAM still enjoys life and attends most colloquia at the Rijksherbarium. We wish him many happy years to come.

SOURCES

M. J. VAN STEENIS-KRUSEMAN. 1949. Cyclopaedia of Collectors. Fl. Males. I, 1: 308–309.

Blumea Supplement IV. 1958. Jubilee volume for Professor Lam. Besides contributions from colleagues it contains also a list of plant and animal names commemorating Professor LAM (by P. VAN ROYEN) and further a complete bibliography up to 1958 (compiled by L. VOGELENZANG).

H. J. LAM. 1962. Tradenda. Mijmeringen bij een afscheid. Leyden.

C. G. G. J. VAN STEENIS. 1962. Bij het aftreden van Lam. Leids Universiteitsblad 27 (no 31): 5–6, portr.

C. G. G. J. VAN STEENIS

acc. = according
Ak. Bis. = Aklan Bisáya (Philip. language)
Alf. Cel. = Alfurese Celebes (language)
alt. = altitude
Anat. = Anatomy
Ap. = Apáyao (Philip. language)
app. = appendix, appendices
appr. = approximate
Apr. = April
Arch. = Archipelago
atl. = atlas
auct. div. = *auctores diversi*; various authors
auct(t). mal. = *auctores malayenses*; authors dealing with Malesian flora
auct(t). plur. = *auctores plures*; several authors
Aug. = August
Bag. = Bagóbo (Philip. language)
basionym = original name of the type specimen; its epithet remains permanently attached to the taxon which is typified by it provided it is of the same rank
Bg. = Buginese (language)
Bik. = Bikol (Philip. language)
Bil. = Bilá-an (Philip. language)
Bill. = Billiton
Bis. = Bisáya (Philip. language)
Bon. = Bontók (Philip. language)
Born. = Borneo
Bt = Bukit; mountain
Bug. = Buginese (language)
Buk. = Bukidnon (Philip. language)
c. = *circiter*; about
C. Bis. = Cebu Bisáya (Philip. language)
cf. = *confer*; compare
Chab. = Chabecáno (Philip. language)
citations = see references
cm = centimetre
c.n. = see *comb. nov.*
comb. nov. = *combinatio nova*; new combination
CS = cross-section or transversal section of an organ
c.s. = *cum suis*; with collaborators
cum fig. = including the figure
cur. = *curante*; edited by
D (after a vernacular name) = Dutch
Daj. = Dyak (language)
Dec. = December
D.E.I. = Dutch East Indies
descr. added behind a reference = means that this contains a valid description
diam. = diameter
Distr. (as an item) = Distribution
Distr. (with a geographical name) = District
dittò = the same, see *do*
Div. = Division, or Divide
div. = *diversus* (masc.); various
do = *ditto* (Ital.); the same
Dum. = Dumágat (Philip. language)
dupl. = duplicate
E = east (after degrees: eastern longitude)
E (after a vernacular name) = English
Ecol. = Ecology
ed. = edited; edition; editor
e.g. = *exempli gratia*; for example
elab. = *elaboravit*; revised
em(end). = *emendavit*; emended
em(erg). ed. = emergency edition
Engl. = English
etc., &c. = *et cetera*; and (the) other things
ex auctt. = *ex auctores*; according to authors
excl. = *exclusus* (masc.); excluding, exclusive of
ex descr. = known to the author only from the description
f. (before a plant name) = *forma*; form
f. (after a personal name) = *filius*; the son
f. (in citations) = figure
fam. = family
Feb(r). = February
fide = according to
fig. = figure
fl. = *flore, floret (floruit)*; (with) flower, flowering
For. Serv. = Forest Service
fr. = *fructu, fructescit*; (with) fruit, fruiting
Fr. (after a vernacular name) = French
G. = Gunung (Malay); mountain
Gad. = Gaddáng (Philip. language)
gen. = *genus*; genus
genus delendum = genus to be rejected
Germ. = German
geront. = Old World
haud = not, not at all
holotype = the specimen on which the original description was actually based or so designated by the original author
homonym = a name which duplicates the name of an earlier described taxon (of the same rank) but which is based on a different type species or type specimen; all later homonyms are nomenclaturally illegitimate, unless conserved
I. = Island
ib(id). = *ibidem*; the same, in the same place
Ibn. = Ibanág (Philip. language)
ic. = *icon, icones*; plate, plates
ic. inedit. = *icon ineditum, icones inedita*; inedited plate(s)
id. = *idem*; the same
i.e. = *id est*; that is
If. = Ifugáo (Philip. language)
Ig. = Igorot (Philip. language)
Ilg. = Ilongót (Philip. language)
Ilk. = Ilóko (Philip. language)
in adnot. = *in adnotatione*; in note, in annotation
incl. = *inclusus* (masc.); including, inclusive(ly)
indet. = indetermined
Indr. = Indragiri (in Central Sumatra)
inedit. = *ineditus* (masc.); inedited
in herb. = *in herbario*; in the herbarium
in litt. = *in litteris*; communicated by letter
in sched. = *in schedula*; on a herbarium sheet
in sicc. = *in sicco*; in a dried state
in syn. = *in synonymis*; in synonymy
Is. = Islands
Is. (after a vernacular name) = Isinái (Philip. language)
Ism. = Isámal (Philip. language)
isotype = a duplicate of the holotype; in arboreous plants isotypes have often been collected from a single tree, shrub, or liana from which the

holotype was also derived
Iv. = Ivatán (Philip. language)
J(av). = Javanese (language)
Jan. = January
Jr = Junior
Klg. = Kalinga (Philip. language)
Kul. = Kuláman (Philip. language)
Kuy. = Kuyónon (Philip. language)
Lamp. = Lampong Districts (in S. Sumatra)
Lan. = Lánao (Philip. language)
lang. = language
l.c. = *loco citato*; compare reference
lectotype = the specimen selected *a posteriori* from the authentic elements on which the taxon was based when no holotype was designated or when the holotype is lost
livr. = livraison, part
ll.cc. = *l.c.* (plur.)
LS = longitudinal or lengthwise section of an organ
m = metre
M = Malay (language)
Mag. = Magindanáo (Philip. language)
Mak. = Makassar, Macassar (in SW. Celebes)
Mal. = Malay(an)
Mal. Pen. = Malay Peninsula
Mand. = Mandáya (Philip. language)
Mang. = Mangyán (Philip. language)
Mar. = March
Mbo = Manóbo (Philip. language)
Md. = Madurese (language)
Minangk. = Minangkabau (a Sumatran language)
min. part. = *pro minore parte*; for the smaller part
mm = millimetre
Mng. = Mangguángan (Philip. language)
Morph. = Morphology
ms(c), MS(S) = manuscript(s)
Mt(s) = Mount(ains)
n. = *numero*; number
N = north (after degrees: northern latitude); or New (*e.g.* in N. Guinea)
NE. = northeast
nec = not
neerl. = Netherlands, Netherlands edition
Neg. = Negrito (Philip. language)
N.E.I. = Netherlands East Indies
neotype = the specimen designated to serve as nomenclatural type when no authentic specimens have existed or when they have been lost; a neotype retains its status as the new type as long as no authentic elements are recovered and as long as it can be shown to be satisfactory in accordance with the original description or figure of the taxon
N.G. = New Guinea
N.I. = Netherlands Indies
no = *numero*; number
nom. = *nomen*; name (only) = *nomen nudum*
nom. al. = *nomen aliorum*; name used by other authors
nom. alt(ern). = *nomen alternativum*; alternative name
nom. cons(erv). = *nomen conservandum, nomina conservanda*; generic name(s) conserved by the International Rules of Botanical Nomenclature
nom. fam. cons. = *nomen familiarum conservandum*; conserved family name
nom. gen. cons. = see *nomen conservandum*
nom. gen. cons. prop. = *nomen genericum conservandum propositum*; generic name proposed for conservation
nom. illeg(it). = *nomen illegitimum*; illegitimate name
nom. leg(it). = *nomen legitimum*; legitimate name
nom. nov. = *nomen novum*; new name
nom. nud. = *nomen nudum*; name published without description and without reference to previous publications
nom. rej(ic). = *nomen rejiciendum*; name rejected by the International Rules of Botanical Nomenclature
nom. seminudum = a name which is provided with some unessential notes or details which cannot be considered to represent a sufficient description which is, according to the International Rules of Botanical Nomenclature, compulsory for valid publication of the name of a taxon
nom. subnudum = *nomen seminudum*
nom. superfl. = a name superfluous when it was published; in most cases it is a name based on the same type as an other earlier specific name
non followed by author's name and year, not placed in parentheses, and put at the end of a citation = means that this author has published the same name mentioned in the citation *independently*. These names (combinations) are therefore homonyms.
Compare p. 247*a* lines 2–4 from top, where there appear to be two different species named *Haloragis oligantha*, one by ARNOTT published in 1836, and another by WIGHT & ARNOTT published in 1834. The latter has priority over the former which is thus invalidated.
The same can happen with generic names. Compare p. 76 where there appear to be two quite different taxa described as *Miquelia*, one by BLUME published June 1838 and one by MIQUEL published Sept. 1838. The first has priority, but the latter has been proposed to be conserved over the first.
(*non* followed by abbreviation of author's name) before a reference (citation) headed by an other author's name = means that the second author has misinterpreted the taxon of the first author. Compare for example p. 213b line 5 from top where it appears that ANDREWS in his Botanical Repository has misapplied the name *Aponogeton monostachyon* as described by LINNÉ *f.*
non al. = *non aliorum*; not of other authors
non vidi = not seen by the author
nov. = *nova* (femin.); new (species, variety, *etc.*)
Nov. = November
n.s. = new series
n. sp. = *nova species*; new species
n. (sp.) prov. = *nomen (specificum) provisorium*; provisional new (specific) name
n.v. = *non vidi*; not seen
NW. = northwest

Oct. = October
op. cit. = *opere citato*; in the work cited
p. = *pagina*; page
P. = Pulau, Pulu (in Malay); Island
Pal(emb). = Palembang
Pamp. = Pampángan (Philip. language)
Pang. = Pangasinán (Philip. language)
paratype = a specimen cited with the original description other than the holotype
part. alt. = for the other part
P. Bis. = Panay Bisáya (Philip. language)
P.I. = Philippine Islands
pl. = plate
plurim. = *plurimus*; most
p.p. = *pro parte*; partly
pr. max. p. = *pro maxima parte*; for the greater part
pro = as far as is concerned
prob. = *probabiliter*; probably
prop. = *propositus*; proposed
Prov. = Province
pr.p. = *pro parte*; partly
pt = part
quae est = which is
quoad basionym, syn., specimina, *etc.* = as far as the basionym, synonym(s), specimen(s), *etc.* are concerned
references = see for abbreviations the list in vol. 5, pp. cxlv-clxv
Res. = Residency
resp. = respective(ly)
S = south (after degrees: southern latitude)
S (after a vernacular name) = Sundanese (language)
Sbl. = Sambáli (Philip. language)
SE. = southeast
sec. = *secus*; according to
sect. = *sectio*; section
sens. ampl. (ampliss.) = *sensu amplo (amplissimo)*; in a wider sense, in the widest sense
sens. lat. = *sensu lato*; in a wide sense
sens. str. (strictiss.) = *sensu stricto (strictissimo)*; in the narrow sense, in the narrowest sense
Sept. = September
seq., seqq. = *sequens, sequentia*; the following
ser. = series
s.l. = *sensu lato*; in a wide sense
S.-L. Bis. = Samar-Leyte Bisáya (Philip. language)
Sml. = Sámal (Philip. language)
s.n. = *sine numero*; (specimen) without the collector's number
Sp. = Spanish (language)
sp(ec). = *species*; species
specim. = specimen(s)
sphalm. = *sphalmate*; by error, erroneous
spp. = *species*; species (plural)
Sr = Senior
s.s. = see *sens. str.*
ssp. = *subspecies*; subspecies
s.str. = see *sens. str.*
stat. nov. = *status nova*; proposed in a new rank
Sub. = Subánum (Philip. language)
subg(en). = *subgenus*; subgenus
subsect. = *subsectio*; subsection
subsp. = *subspecies*; subspecies
Sul. = Súlu (Philip. language)
Sum. E.C. = Sumatra East Coast
Sum. W.C. = Sumatra West Coast
Suppl. = Supplement
SW. = southwest
syn. = *synonymum*; synonym
synonyms = the names of taxa which have been referred to an earlier described taxon of the same rank and with which they have been united on taxonomical grounds or which are bound together nomenclaturally
syntypes = the specimens used by the original author when no holotype was designed or more specimens were simultaneously designated as type
t. = *tabula*; plate
Tag. = Tagálog (Philip. language)
Tagb. = Tagbanúa (Philip. language)
Tagk. = Tagaká-ólo (Philip. language)
Tapan. = Tapanuli (in NW. Sumatra)
taxon = each entity throughout the hierarchic ranks of the plant kingdom which can be described and discriminated from other taxa of the same rank
Taxon. = Taxonomy
Tg = Tandjung (Malay); cape
Ting. = Tinggián (Philip. language)
Tir. = Tiruraí (Philip. language)
transl. = translated
type = each taxon above the rank of a species is typified by a type belonging to a lower rank, for instance a family by a genus, a genus in its turn by a species; a species or infraspecific taxon is typified by a specimen. The name of a taxon is nomenclaturally permanently attached to its type; from this it cannot be inferred that the type always represents botanically the most typical or average structure found in the circumscription of the taxon
type specimen = the specimen or other element to which the name of a species or infraspecific taxon is (nomenclaturally) permanently attached; botanically a type specimen is a random specimen on which the name was based by description. Therefore, it does not need to represent the average or most typical representative of a population. See holotype, isotype, lectotype, syntype, paratype, and neotype
typ. excl. = *typo excluso*; type exluded
typ. incl. = *typo incluso*; type included
typus = see type and type specimen
var. = *varietas*; variety
var. nov. = *varietas nova*; new variety
Vern. = Vernacular
vide = see
viz = *videlicet*; namely
vol. = volume
W = west (after degrees: western longitude)
Yak. = Yakán (Philip. language)
± = about
& = and
∅ = diameter
♂ = male (flower, *etc.*)

♀ = female (flower, *etc.*)
☿, ♂ = bisexual (flower)
(♂) (♀) = dioecious with unisexual flowers
(♂♀) = monoecious with unisexual flowers
(♂☿) = polygamous
(♀☿) = polygamous

∾ = many
> = more than (in size, number, *etc.*)
< = less than (size, number, *etc.*)
× 2/5 = 2/5 of natural size
× *montana* = means that the epithet *montana* is that of a hybrid

LEEACEAE (C. E. Ridsdale[1], Leyden)

The monogeneric family is placed in the *Rhamnales* in the system of ENGLER and is closely allied to the *Vitaceae*, sometimes considered as a subfamily or tribe of that family. Distinguished from the *Vitaceae* by the development of a complex staminodial tube, by the presence of one ovule in each locule of the ovary. Pollen is also distinct from that in *Vitaceae*, supporting the segregation into a separate family. Seed and embryo features and the presence of pearl glands on the vegetative organs indicate a very close affinity with the *Vitaceae* but not to other families.

LEEA

VAN ROYEN *ex* LINNÉ, Syst. Nat. ed. 12, 2 (1767) 627 & Mantissa 1 (1767) 17, 124, *nom. cons.*; CLARKE, J. Bot. 19 (1881) 101–138; GAGNEP. Bull. Soc. Bot. Fr. 57 (1910) 331–336; SUESSENGUTH in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 382; RIDSDALE, Blumea 22 (1974) 57–100, with full synonymy and typification. — *Nalagu* ADANS. Fam. Pl. 2 (1763) 445, 581, *nom. rej.*; DENNST. Schlüssel Hort. Mal. (1818) 13, 27. — *Aquilicia* LINNÉ, Mantissa 2 (1771) 146, 211. — *Otillis* GAERTN. Fruct. 1 (1788) *icon. tab.* 57 f. 7, *nom. inval.* — *Ticorea* BLANCO, Fl. Filip. (1837) 85. — **Fig. 1–24.**

Trees, erect or creeping shrubs, scramblers, or herbaceous plants with a woody base; stems noded, unarmed, rarely with rows of spines. *Leaves* distichous, 1-foliolate, 3-foliolate, or 1- to 4-pinnate, usually imperfectly imparipinnate. Petiole or base of petiole expanded to form at both margins a stipular structure surrounding the stem apex, stipules narrowly sheathing and somewhat persistent or large, obovate and caducous. Leaflets opposite on noded rachis, glabrous or pubescent with hairs simple; pearl glands usually present on the undersurface, globular or stellate; margins crenate to serrate-dentate, lobes glandular. *Inflorescences* in leaf-opposed cymes, lax or condensed by reduction of inflorescence branches, or peduncle, or both, erect or pendulous. *Flowers* bisexual, actinomorphic, 4- or 5-merous, rarely both in the same inflorescence. *Calyx* campanulate with triangular lobes, lobes glandular at the apex. *Corolla* lobes valvate in the bud cohesing by an apical keel, reflexed at maturity; basal portion choripetalous, adnate to androecium. *Staminodial tube* joined to the corolla at one point dividing the structure into an upper and lower portion. Upper portion of 4 or 5 thickened lobes connate to each other by thinner tissues which form sinuses over which the filaments pass; lobes retuse, retusely apiculate to bifid at apex. Lower portion forming a free collar, sometimes extending as far as the ovary. *Filaments* arising from a basal portion of the upper part of the staminodial tube and extending over the sinuses; anthers introrse, usually syngenesious and detaching as a unit by breakage at the base of the filaments, rarely free, sometimes becoming extrorse by inflexion. *Ovary* discoidal, 4–8-celled, each cell with 1 ovule; style short, entire; stigma slightly thickened, glabrous; ovules anatropous, basally attached. *Fruit* a berry, depressed-subglobose; seeds triangularly ovate in section, endosperm ruminate. Embryo linear.

---

(1) B. A. KRUKOFF botanist of Malesian Botany.

Distribution. A genus of 34 *spp.* of which 25 *spp.* are endemic in Malesia (with a few species extending to Queensland, Micronesia, and Fiji), 6 in SE. Asia (from Ceylon to S. China), 1 being widely distributed from tropical Africa and Madagascar through SE. Asia and Malesia to Taiwan and Micronesia, 1 *sp.* endemic in Madagascar and 1 *sp.* in the isle of Sao Tomé (W. Africa). Fig. 1.

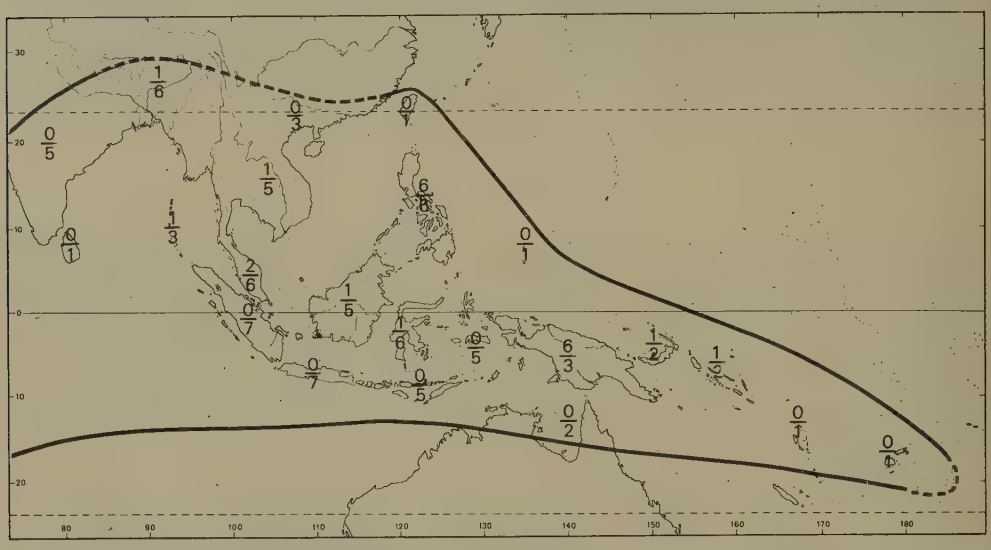

Fig. 1. Range of *Leea* in Indo-Pacific (Africa and Malagasy omitted); numbers above the hyphen indicate endemic species for each area or inland group, those below the hyphen the other non-endemic species.

The occurrence of *L. philippinensis* in the island of Botel Tobago, near Taiwan, is plant-geographically interesting as this is not collected in the mainland of Taiwan.

Fossil species have been described (fossil wood) from the Tertiary in Japan and Nagpur (India).

Ecology. The majority of the wide-spread species is limited to secondary vegetation, particularly riverine forest, some extending into areas with a temporary dry, seasonal climate. Species with limited distributions tend to be confined to the understorey of primary forest, and are also frequently found along streams.

Most Malesian species are found below 1000 m, but there are a few ascending somewhat higher and occasionally to 1500 m (*L. coryphantha*, *L. guineensis*) or even to 1700 m (*L. indica*); it is noteworthy that *L. guineensis* and *L. indica* find their highest stations in the Himalayan range, at 2250 and 2500 m respectively.

Little is known about the flower biology but Dr M. A. LIEFTINCK assured us that the inconspicuous scentless flowers of the greenish-white flowered species are frequented by short-tongued bees and sylphids. It should be added that in the flowers no disk is found; it might occur that honey is produced by receptacular tissue or that the insects are attracted by the conspicuous glandular tissue on the (dorsal) connective; field observations are needed.

Taxonomy. CLARKE, *l.c.*, has proposed a subdivision of series and sections, but I found them unreliable and refrain from any subdivision.

Some species appear to be very variable, while no tangible infraspecific subdivision can be made on the basis of herbarium specimens.

In many species the degree of pinnation of the leaf is exceedingly variable. Recognition of species differentiated solely on whether the leaves are 1-foliolate, 3-foliolate, or pinnate is abandoned. This is also the developmental sequence of leaves in growing seedlings. In such variable species flowering of plants with 1- or 3-foliolate leaves is considered to be precocious. These observations have led to a considerable reduction in the number of species.

Morphology. *Habit.* Most species are smallish shrubs, some only woody at the base. Several may, however, attain some 10 m in height (*L. aequata*, *L. aculeata*) and four are even recorded to 15 m tall (*L. angulata*, *L. indica*, *L. macropus*, *L. tetramera*).

Two Malesian species are armed with spines (enations), *viz L. aculeata* (mostly on trunk and main branches) and *L. angulata* (from trunk to ultimate branches). Fig. 3 (17′).

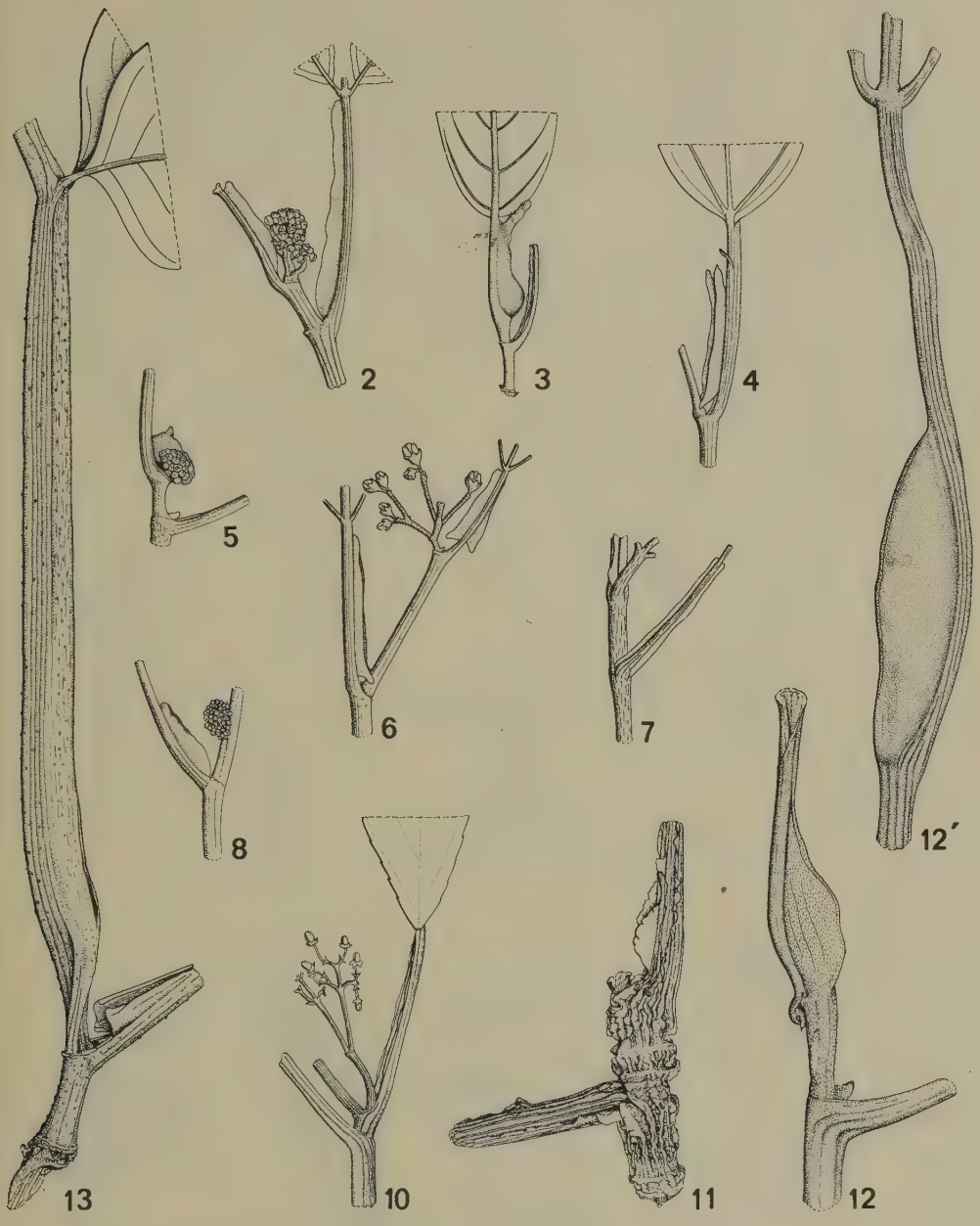

Fig. 2. Shapes of stipules in *Leea* species, the numbers corresponding with the species numbers in the text: 2. LOHER 352; 3. JACOBS 7803; 4. BS 33633; 5. VIDAL 1027; 6. PNH 21592; 7. HALLIER 2462; 8. KERR 7535; 10. VAN ROYEN & SLEUMER 7270; 11. BW 3405; 12. DOCTERS VAN LEEUWEN 9333, 12′. NGF 31590; 13. PULLEN 5436. All × $^1/_2$.

Fig. 3. Shapes of stipules in *Leea* species, the numbers corresponding with the species numbers in the text: 16. BSIP 11244, 16′. NGF 31590; 17. Ja. 3742, 17′. VAN STEENIS 5333; 18. MERRILL 1825; 19. KREMPF *s.n.*; 21. KERR 21534, 21′. SPECHT 1305; 22. RIDLEY 305; 23. HAINES 4755, 23′. BS 31254, 23″. BS 30338, 23‴. BS 41900; 24. JACOBS 7945, 24′. RUTTEN *s.n.*, 24″. BSIP 5371; 25. KOORDERS 15876. All × $^1/_2$.

Two species are occasionally recorded to be stilt-rooted, at least in large specimens, *viz L. indica* and *L. macropus*, while *L. tetramera* is said to have buttresses.

Seedlings. Leaf development is from 1- to 3-foliolate and pinnate. See for further details BURGER (Seedlings of some tropical trees and shrubs, mainly of S.E. ASIA, 1972, 379–383, fig. 154, 155).

Stipules. The stipular structures of the distant leaf are adpressed to form together a sheath surrounding the apex of the stem. As the latter continues growth the stipules are forced apart and drop off or remain as torn structures. There are basically two types, the long, narrow wing type which is usually semi-persistent and, when caducous, leaving but a thin scar, and the obovate type which is rapidly caducous and leaves a broad triangular scar. Some intermediate forms are sometimes encountered. See fig. 2, 3, and also 5 and 18.

Floral morphology. The conspicuous feature of the flowers is the presence of a staminodial tube within the whorl of stamens. Fig. 23 *c–f*. Basipetally the staminodial tube continues beyond the insertion, thus dividing the staminodial tube into an upper free part and a lower collar-like part which is usually free. Fig. 5f. The upper part of the staminodial tube is composed of 4 or 5 lobes divided from each other by sinuses over which the filaments pass. The apex of the lobes of the staminodial tube is usually retusely notched (fig. 9b) but in some cases may be deeply bifid. The lower portion of the staminodial tube is usually a free collar of varying length. It may also be adnate to the lower part of the corolla tube, from which it may be differentiated by the presence of a large number of raphids. The corolla tube itself is a composite structure composed of corolla and staminodial elements. In the descriptions the length of the 'corolla tube + staminodial lobes' is given, being the length from the base of the composite corolla tube to the tip of the lobes of the upper part of the staminodial tube. The length of the free corolla lobes is given separately. Distally from the line of insertion of the staminodial tube on the corolla tube the tissues often form a small rim on which the stamens are inserted. The filaments pass over the sinus of the staminodial tube. The anthers are basically dorsifixed. The connective is well developed on the dorsal side of the anthers and is purple-black in colour and conspicuously glandular. Filament-like tissue continues over the connective acropetally and basipetally beyond the point of insertion.

In most taxa the anthers in the bud and newly opened flowers are strongly syngenesious. At anthesis the anthers bend outwards and backwards, the movement causes the anthers to gradually be elevated and pulled out of the staminodial tube. For the stamens to actually elevate a degree of breakage of the tissue holding the anthers together is required. If this is slight or non existent then only partial movement can occur, the anthers remain together in a cylinder and usually a number of the filaments break. The unit then moves out of the staminodial tube and soon detaches from the flower. A high degree of rupture of the tissue enables the anthers to leave the staminodial tube completely. They then sit as a star-shaped plate above the tube (fig. 23a). Complete breakage of the tissue will cause the anthers to complete reflex and to appear seemingly introrse.

Seeds. Endosperm ruminate, basically with 5 ingrowths, one along the median plane, two from the raphe, and one at each lateral face. The latter ingrowths leave a pattern on the outer surface of the seed, referred to as the 'rumination outline'. Fig. 5g. The ingrowths are produced by meristematic activity of the middle layers of the outer integument which causes the inner layers to be intruded. Extra ingrowths may also occur on the lateral faces. The ingrowths themselves may also become much branched and reticulate, either the median plate alone, the ingrowths of the lateral faces alone, or both lateral face and median plate. **Fig. 4.**

Chemotaxonomy. Detailed chemical investigations are lacking. Most species of *Leea* seem to be non-toxic and mucilaginous (see for Indian species: The Wealth of India, Raw Materials, vol. 6, New Delhi 1962, 56–57). Medicinal uses of roots, stems and leaves in India and Africa seem to be connected mainly with an abundance of phenolic constituents. Flavonols, p-hydroxybenzoic acid, syringic acid and gallic acid and flavan-3, 4-diols (= leucoanthocyanidins) were demonstrated to be present in leaves of *L. guineensis* G. DON (= *L. coccinea* PLANCH.), *L. indica* MERR. (= *L. sambucina* WILLD.), and *L. rubra* BL. *ex* SPRENG. Tannins may also be present in appreciable amounts in some species. At present it is still impossible to appreciate the chemistry of *Leeaceae* from a systematic point of view, because too little information is available. The type of polyphenolic constituents known to be present and the fact that oxalate of lime occurs in the form of raphids, however, point to an affinity with *Vitaceae* (for references see: R. HEGNAUER, Chemotaxonomie der Pflanzen, vol. 6, Birkhäuser-Verlag, Basel, 1973). — R. HEGNAUER.

Anatomy. For general surveys also covering the older literature see SOLEREDER, Syst. Anat. Dicot. Stuttgart (1899) 251–257 and *ibid.* (1908) 103–104, METCALFE & CHALK, Anat. Dicot. Oxford (1950) 413–419, and SUESSENGUTH in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 375. Selected references: DEN BERGER, Determinatietabel Malesië, Veenman, Wageningen (1949) (wood identifications); DESCH, Mal. For. Rec. 15 (1941) 5 (wood); JANSSONIUS, Blumea 6 (1950) 430 (wood anatomical affinities); JANSSONIUS, Key to Javanese woods, Leyden (1952); JUTTE, Nova Guinea n.s. 10 (1959) 272 (wood anatomy); MOLL & JANSSONIUS, Mikr. 2 (1911) 303–316 (wood anatomy); RACIBORSKI, Flora 85 (1898) 358–361 (glands, 'food-bodies', hairs); ZUBKOVA, Bot. J. USSR 50 (1965) 1556–1567 (petiole).

The wood of *Leea* is characterized by diffuse solitary and grouped vessels with scalariform inter-vessel pits, large and simple vessel-ray pits and simple perforations. Scalariform perforations have been noted

Fig. 4. Different types of ruminate endosperm in seeds of *Leea*, all in section. *a. L. acuminatissima*, *b. L. coryphantha*, *c. L. magnifolia*, *d. L. compactiflora*, *e. L. indica*.

near the primary xylem of a few species only. The septate fibres are provided with minutely bordered pits. Parenchyma is scanty paratracheal, and the rays are usually of two distinct sizes. Broad heterogeneous rays are always present. The occurrence of raphides in the ray cells of most species is one of the outstanding characters. Solitary crystals may also occur.

The young stem is characterized by many raphide-cells also containing mucilage in the gland tissue, broad primary rays, fibre bundles near the primary phloem and superficial cork.

Characters of the leaves include globular glands, which possess a stoma more or less in apical position (fig. 19), and of which the anatomy seems to differ slightly from the 'classical' pearl glands of *Vitaceae sens. str.* Simple uniseriate hairs also occur, and according to RACIBORSKI the petiole may be clad with 'Ameisenfutterkörper' (food-bodies for ants), the anatomy of which recalls Vitaceous pearl glands but which lack stomata. The stomata are recorded to be anomocytic, but are in need of further studies.

Raphides and large druses occur in the mesophyll in varying frequencies. The petiole is supplied with a closed ring of vascular tissue, whether or not with an extra dorsal 'cortical' bundle.

In spite of some wood anatomical differences, which may be interpreted as due to different habits (tree versus liane), *Leea* shares many characters with *Vitaceae sens. str.* in which it was formerly included. The wood anatomy bears also strong resemblance to that in *Arthrophyllum* of the *Araliaceae*, but this seems due to convergent evolution in the absence of other evidence supporting mutual affinities. — P. BAAS.

Note. Identification of fruiting material without stipules present on the material is difficult; good flowering material with adequate field notes is required. Distinguishing some forms of *L. indica* from *L. guineensis* without some knowledge of flower colour is difficult.

KEY TO THE SPECIES

1. Leaves 1-foliolate (or rarely 3-foliolate).
 2. Flowers 4-merous. Fruit usually 4-seeded. Philippines.
  3. Leaflets obovate, pair of foliar outgrowths (rarely seen as reduced leaflets) above the stipular wing . . . . . **1. L. magnifolia**
  3. Leaflets elliptic or ovate, foliar outgrowths absent.
   4. Seeds complexely ruminate (fig. 4a). Leaflets up to 22 by 9 cm . . . . . **3. L. acuminatissima**
   4. Seeds simply ruminate (compare fig. 4d–e). Leaflets usually over 22 by 9 cm . . **4. L. unifoliata**
 2. Flowers 5-merous. Fruits usually 6-seeded (sometimes less by abortion). Not in Philippines.
  5. Corolla tube + staminodial lobes less than 3 mm long, lower free part of staminodial tube up to $^1/_2$ mm. Fruit usually up to 10 mm ⌀. Malaya, Sumatra, Java . . . . . **8. L. simplicifolia**
  5. Corolla tube + staminodial lobes over 3 mm long, lower free part of staminodial tube over $^1/_2$ mm. Fruit usually over 10 mm ⌀. New Guinea.

6. Corolla tube + staminodial lobes less than $4^1/_2$ mm. Leaflet base subauriculate. **9. L. gonioptera**
6. Corolla tube + staminodial lobes over $4^1/_2$ mm. Leaflet base cuneate to truncate **10. L. zippeliana**

1. Leaves 1–4-pinnate.
7. Stipule a narrow wing, somewhat persistent, scar long and thin. Compare fig. 2 (4, 7, 13).
8. Flowers 4-merous. Fruits usually 4-seeded (if 6-seeded then fruit over 20 mm ⌀).
9. Staminodial tube over 5 mm long. Fruits over 20 mm ⌀, 6-seeded. New Guinea and Solomon Is.
10. Lobes of staminodial tube strongly bifid. Inflorescences condensed, erect. Flowers orange-yellow. Mainland of New Guinea . . . . . **13. L. papuana**
10. Lobes of staminodial tube retuse. Inflorescences lax, pendulous. Flowers white. Solomon Is. **16. L. tetramera**
9. Staminodial tube less than 5 mm. Fruit less than 20 mm ⌀, 4-seeded. Philippines.
11. Style over 3 mm long; staminodial tube 4–5 mm long; filaments over 2 mm. Inflorescence generally condensed, 3-branched, peduncle usually up to 3 cm. Young parts sometimes fulvously pubescent. Leaflets usually elliptic to elliptic-lanceolate, over 7 cm wide; ultimate venation distinct. Rumination outline in seed simple to slightly branched . . . . . **2. L. quadrifida**
11. Style up to 2 mm long; staminodial tube $2^1/_2$–4 mm; filaments up to 2 mm. Inflorescence generally lax and multi-branched, peduncle over 3 cm. Young parts never fulvous pubescent. Leaflets generally ovate to ovate-lanceolate and less than 7 cm wide; ultimate venation indistinct. Rumination outline in seed complexly reticulate . . . . . **6. L. philippinensis**
8. Flowers 5-merous. Fruit usually 6-seeded.
12. Stems spiny.
13. Leaves 1-pinnate . . . . . **18. L. aculeata**
13. Leaves 2- or 3–4-pinnate . . . . . **17. L. angulata**
12. Stems not spiny or information lacking.
14. Corolla tube + staminodial lobes 6 mm or more and staminodial tube over $5^1/_4$ mm long. Fruit where known over 20 mm ⌀. New Guinea and Solomon Is.
15. Leaves 3- or 4-pinnate, leaflets up to 14 by 5 cm. Flowers pink. Mainland New Guinea **14. L. krukoffiana**
15. Leaves 1- or 2-pinnate, leaflets mostly over 14 by 5 cm. Flowers not pink.
16. Lobes of staminodial tube strongly bifid. Inflorescence condensed, erect. Flowers orange-yellow. Mainland New Guinea . . . . . **13. L. papuana**
16. Lobes of staminodial tube retuse. Inflorescence lax, pendulous. Bismarck Archipelago and Solomon Is.
17. Inflorescence usually glabrous. Corolla tube + staminodial lobes 8–11 mm, filaments 5–7 mm, anthers 3–5 mm. Young parts not fulvously pubescent. Bismarck Archipelago **15. L. macropus**
17. Inflorescence usually fulvously pubescent. Corolla tube + staminodial lobes 6–8 mm, filaments 3 mm, anthers 2 mm. Young parts usually fulvously pubescent. Solomon Is. **16. L. tetramera**
14. Corolla tube + staminodial lobes up to 6 mm or staminodial tube less than $5^1/_4$ mm long. Fruit less than 20 mm ⌀. Not in New Guinea except for *L. gonioptera* and *L. aculeata*.
18. Leaves 1-pinnate.
19. Corolla tube + staminodial lobes up to $2^1/_2$ mm, staminodial tube up to $1^1/_2$ mm long. Small shrubs with creeping rootstock . . . . . **8. L. simplicifolia**
19. Corolla tube + staminodial lobes over $2^1/_2$ mm; staminodial tube over $1^1/_2$ mm. Shrubs or trees.
20. Flowers red . . . . . **22. L. saxatilis**
20. Flowers green or white.
21. Calyx ± inflated around the corolla tube, completely enclosing the corolla in the bud. Corolla tube + staminodial lobes over 5 mm, staminodial tube over 4 mm. Fruit *c.* 20 mm ⌀ . . . . . **7. L. amabilis**
21. Calyx not enclosing the corolla in the bud, not so inflated. Corolla tube + staminodial lobes less than 5 mm, staminodial tube less than 4 mm. Fruit usually less than 15 mm (rarely to 20 mm) ⌀.
22. Leaflet base subauriculate. Stem smooth. Staminodial tube up to 3 mm long, lower free part up to $1^1/_4$ mm long. New Guinea . . . . . **9. L. gonioptera**
22. Leaflet base rounded to cuneate. Stem spiny. Staminodial tube 3–$3^1/_2$ mm long, lower free part over $1^1/_4$ mm long. Scattered throughout Malesia, except Malaya, very rare in W. New Guinea . . . . . **18. L. aculeata**
18. Leaves 2- to 4-pinnate.
23. Staminodial tube up to $2^1/_4$ mm long. Stipules up to 6 cm long. Petiole generally less than 10 cm.
24. Corolla tube + staminodial lobes over $3^1/_4$ mm, sinuses of staminodial tube shallow. Flowers greenish white. Fruit greyish blue. Stems and ultimate branches spiny. **17. L. angulata**

24. Corolla tube + staminodial lobes at least $2^1/_4$ mm long, sinuses of staminodial tube shallow. Flowers red. Fruit red. Stems and branches not spiny . . . . . **21. L. rubra**
23. Staminodial tube at least $2^1/_2$ mm long. Stipules usually over 6 cm long. Petiole generally over 10 cm . . . . . **19. L. curtisii**

7. Stipule obovate, caducous, leaving a broad scar. Compare fig. 3 (21, 23, 24).
25. Flowers 4-merous. Fruits usually 4-seeded. Philippines. . . . . **5. L. congesta**
25. Flowers 5-merous. Fruits usually 6-seeded.
26. Leaves 1-pinnate.
27. Flowers red to orange-yellow . . . . . **23. L. guineensis**
27. Flowers greenish white.
28. Corolla tube + staminodial lobes over 4 mm, staminodial tube over $2^3/_4$ mm. Fruit *c.* 20 mm ⌀.
29. Sinuses of staminodial tube deep, *c.* 1 mm. Leaflets generally over 30 cm long. **12. L. coryphantha**
29. Sinuses of staminodial tube shallow to $^1/_2$ mm. Leaflets generally but not exclusively up to 30 cm long. . . . . **11. L. heterodoxa**
28. Corolla tube + staminodial lobes less than 4 mm, staminodial tube less than $2^3/_4$ mm. Fruit up to 15 mm ⌀ . . . . . **24. L. indica**
26. Leaves 2–4-pinnate.
30. Corolla tube + staminodial lobes over 4 mm, staminodial tube over 3 mm. Fruit at least 20 mm ⌀. New Guinea.
31. Sinuses of staminodial tube deep, *c.* 1 mm. Leaflets generally over 30 by 9 cm, nerves usually over 10 pairs. Stipular scar generally over 4 cm long . . . . . **12. L. coryphantha**
31. Sinuses of staminodial tube shallow, less than $^1/_2$ mm. Leaflets generally less than 30 by 9 cm, nerves generally less than 10 pairs. Stipular scar up to 4 cm long . . . . **11. L. heterodoxa**
30. Corolla tube + staminodial lobes less than 4 mm, staminodial tube less than 3 mm. Fruit less than 20 mm ⌀.
32. Inflorescence and leaflets with large, discoidal, pallid brown pearl glands. Bracts of inflorescence large, conspicuous, up to 8 by 5 mm . . . . . **20. L. aequata**
32. Pearl glands inconspicuous, or absent. Bracts smaller, inconspicuous.
33. Petiole, rachis, and costa with crisped fluted emergences. Leaflets large, 30–40 by 10–17 cm. Celebes . . . . . **25. L. smithii**
33. Emergences absent. Leaflets usually, but not exclusively, smaller.
34. Flowers greenish-white . . . . . **24. L. indica**
34. Flowers red to orange-yellow.
35. Corolla tube + staminodial lobes generally over 3 mm, staminodial tube over 2 mm, sinuses of staminodial tube shallow . . . . . **23. L. guineensis**
35. Corolla tube + staminodial lobes up to 3 mm, staminodial tube less than 2 mm, sinuses of staminodial tube deep . . . . . **21. L. rubra**

1. Leea magnifolia MERR. Publ. Govt. Lab. Philip. 35 (1906) 37; En. Philip. 3 (1923) 12; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 386; RIDSDALE, Blumea 22 (1974) 79, f. 2/7, 5, 6/4, 8/3. — *L. banahaensis* ELM. Leafl. Philip. Bot. 1 (1908) 318; MERR. En. Philip. 3 (1923) 11; SUESSENG. *l.c.* — *L. pycnantha* QUIS. & MERR. Philip. J. Sc. 37 (1928) 166; SUESSENG. *l.c.* — *L. catanduanensis* QUIS. Philip. J. Sc. 76 (1944) 203 (erroneously numbered as pt 3 page 47). — **Fig. 4c, 5.**

Small treelet 1–3 m, stem often corrugated to fluted. *Leaves* usually appearing as 1-foliolate by reduction of the lowest pair of leaflets of a 3- or 5-foliolate leaf to structureless foliar outgrowths. Petiole 1–12 cm; *stipules* a narrow wing, 3–11 mm broad, along the entire length of the petiole, scars similarly long, narrow. Leaflets broadly obovate to obovate (-oblong), (18–) 25–60 (–75) by (10–) 15–25 (–30) cm (lateral leaflets if present to 6 by 4 cm), glabrous, subcoriaceous; pearl glands numerous, black, stellate; margin toothed; apex acuminate; base rounded to obtuse; nerves 12–20 pairs, veins minutely pubescent. *Inflorescences* 3–9 (–14) cm long, condensed, glabrous; bracts narrowly triangular up to 5 by 3 mm; peduncle up to 4 cm long, usually bearing 3 main branches, ultimate branches highly condensed. *Flowers* 4-merous, creamy white. Calyx *c.* 4 by 4 mm, lobes 2 by 2 mm. Corolla tube + staminodial lobes 5 mm; corolla lobes 3 by 2 mm. Staminodial tube *c.* 4 mm long; upper free part $2^1/_2$–3 mm, lobes shallowly retuse, somewhat fleshy, sinuses shallow; lower free part $^1/_2$ mm. Filaments 2 mm, anthers 2 mm. Ovary 4-celled, style 3 mm. *Fruit* 10–12 mm ⌀, yellow to orange-brown; seeds usually 4, *c.* 7 by 7 mm, rumination outline complexly reticulate, endosperm complexly ruminate.

Distr. *Malesia*: Philippines: Luzon (Aurora, Nueva Vizcaya, Rizal, Tayabas), Alabat, Catanduanes, Mindoro (Orient.). Fig. 8.

Ecol. Primary lowland and foothill forest, to 1500 m, particularly along streamsides.

2. Leea quadrifida MERR. Philip. J. Sc. 5 (1910) Bot. 196; En. Philip. 3 (1923) 14; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 388; RIDSDALE, Blumea 22 (1974) 80, f. 2/6. — *L.*

Fig. 5. *Leea magnifolia* MERR. *a*. Habit, *b*. *ditto*, *c*. leaf, *d*. inflorescence and stipules, all × 1/3, *e*. flower, *f*. *ditto* in LS, both × 5, *g*. embryo, × 2 (*a* PNH 18176, *b*, *e–f* JACOBS 7946, *c* JACOBS 7734, *d* BS 40670, *g* ELMER 14692).

agusanensis ELM. Leafl. Philip. Bot. 8 (1915) 2881; MERR. En. Philip. 3 (1923) 10; SUESSENG. *l.c.* 386. — *L. platyphylla* MERR. Philip. J. Sc. 17 (1920) 280; En. Philip. 3 (1923) 14; SUESSENG. *l.c.* 386. — **Fig. 2.**

Small treelet up to 5 m, stem up to 4 cm ⌀. *Leaves* 1-pinnate, 5–9 crowded at the apex of the stem; leaflets (5–) 7–11 (–13). Petiole 5–25 cm; *stipules* a narrow wing 5–12 mm broad, along the whole length of the petiole, scars similarly long, narrow; rachis (8–) 11–30 (–45) cm long. Leaflets elliptic to elliptic-oblong (-lanceolate), (7–) 15–30 (–35) by (3–) 8–12 (–16) cm, glabrous to sparsely fulvously pubescent, (sub)coriaceous; pearl glands sometimes dense and conspicuous, stellate; margin repand to shallowly dentate; apex acuminate; base obtuse to cuneate; nerves 8–16 pairs; petiolules 5–20 mm. *Inflorescences* 2–12 (–20) cm long, condensed, glabrous to densely fulvously pubescent; bracts deltoid to narrowly triangular, up to 4 by 2 mm; peduncle 1–3 (–6) cm long, usually bearing 3 branches, ultimate branches highly condensed. *Flowers* 4-merous, white. Calyx 4 by 4 mm, lobes $1^3/_4$ by 2 mm. Corolla tube + staminodial lobes 5–6 mm long; corolla lobes 3–4 by $2–2^1/_2$ mm. Staminodial tube 4–5 mm long; upper free part $3–3^1/_2$ mm, lobes shallowly retuse, sinuses shallow; lower free part 1 mm. Filaments $2–2^1/_2$ mm, anthers 1–2 mm. Ovary 4-celled; style 2–4 mm. *Fruit* 15 mm ⌀, orange-brown; seeds usually 4, *c.* 7 by 5 mm, rumination outline simple or slightly branched.

Distr. *Malesia*: Philippines: Luzon (Benguet, Cagayan, Ilocos Norte, Isabela, Laguna, Nueva Ecija, Nueva Vizcaya, Pampanga), Biliran, Bohol, Mindanao (Agusan, Davao, Surigao). Fig. 13.

Ecol. Primary rain forest to 1000 m, often on ridges.

Note. In general the material previously included in taxa other than *L. quadrifida* has a tendency to have larger, more glabrous leaves and a seed with a simpler rumination outline. Material corresponding to that described as *L. quadrifida* tends to occur more commonly on ridges, particularly those bearing mossy forest.

3. Leea acuminatissima MERR. Philip. J. Sc. 12 (1917) Bot. 281; En. Philip. 3 (1923) 10; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 386; RIDSDALE, Blumea 22 (1974) 80, f. 2/5, 8/1. — **Fig. 2, 4a.**

Treelet up to 3 m. *Leaves* 1-foliolate, 7–9 clustered at the apex of the stem. Petiole 2–6 cm; *stipules* a narrow wing *c.* 5 mm broad along the entire length of the petiole. Leaflets elliptic to elliptic-oblong or ovate-oblong, 13–22 by 4–9 cm, glabrous, coriaceous; pearl glands sparse, stellate; margin crenately lobed; apex acuminate; base subcordate; nerves *c.* 14 pairs. *Inflorescences c.* 5 cm long, condensed, few-flowered, ± glabrous; bracts triangular, up to 5 by 3 mm; peduncle 1–3 cm, usually with 3 short main branches, ultimate branches few. *Flowers* 4-merous, only fragments seen. Calyx *c.* $2^1/_2$ by $2^1/_2$ mm, lobes triangular, 1 by $1^1/_2$ mm. Corolla tube + staminodial lobes *c.* 3 mm; corolla lobes *c.* 2 mm long. Staminodial tube: upper free part *c.* $1^1/_2$ mm, lobes slightly cleft, sinuses shallow; lower free part indiscernible. Filaments $1^1/_4$ mm, anthers 1 mm. Ovary appearing 4-celled; style *c.* 1 mm. *Fruit* 15 mm ⌀, red; seeds usually 4, *c.* 6 by 6 mm, rumination outline complexly reticulate, endosperm complexly ruminate.

Distr. *Malesia*: Philippines: Luzon (Aurora-Sierra Madre Mts, Nueva Ecija), only 2 collections. Fig. 6.

Ecol. Primary lowland and foothill forest to 1250 m.

Note. The status of this species is uncertain and further collections and field observations are required. It may only be a precociously flowering, 1-foliolate form of a pinnately leaved species.

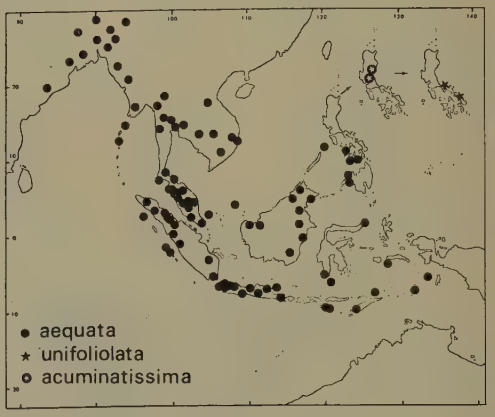

Fig. 6. Range of three *Leea* species; of *L. aequata* L. the localities from the western part of India are omitted.

4. Leea unifoliata MERR. Philip. J. Sc. 11 (1916) Bot. 193; En. Philip. 3 (1923) 14; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 383, 390; RIDSDALE, Blumea 22 (1974) 80, f. 2/4. — *L. longipetiolata* MERR. Philip. J. Sc. 17 (1920) 282; En. Philip. 3 (1923) 12; SUESSENG. *l.c.* 386. — **Fig. 2.**

Small treelet, young parts rusty pubescent. *Leaves* 1-foliolate. Petiole 3–7 cm; *stipules* a narrow wing *c.* 5 mm broad along the entire length of the petiole, scar similarly long. Leaflets elliptic-oblong, 22–30 by 9–13 cm, sparsely pubescent, chartaceous to subcoriaceous; pearl glands sparse, sphaeroid-depressed; margin shallowly toothed; apex acuminate to cuspidate; base acute; nerves 10–14 pairs, rusty pubescent. *Inflorescences c.* 3 cm, condensed, few-flowered, rusty pubescent; bracts narrowly triangular up to 5 by 2 mm; peduncle short, *c.* 1 cm, with 3 short main branches, ultimate branches few, condensed. *Flowers* 4-merous, immature. Calyx *c.* 4 by 4 mm,

lobes triangular, 1 by $1^1/_2$–2 mm. Lobes of staminodial tube shallowly retuse, sinuses shallow. *Fruit c.* 20 mm ⌀; seeds usually 4, *c.* 7 by 5 mm, rumination outline simple, endosperm simply ruminate.

Distr. *Malesia*: Philippines: Luzon (Camarines), Samar, only 2 collections. Fig. 6.

Ecol. Lowland primary forest, particularly often along streamsides.

Note. From the collections available this species appears to be distinct from *L. acuminatissima*. However, it could well represent a precociously flowering 1-foliolate form of one of the pinnately leaved species, particularly of *L. quadrifida*. Further collections and field observations are required.

5. Leea congesta ELM. Leafl. Philip. Bot. 1 (1908) 318; C. B. ROB. Philip. J. Sc. 6 (1911) Bot. 209; MERR. En. Philip. 3 (1923) 11; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 386; RIDSDALE, Blumea 22 (1974) 80, f. 4/1. — *L. capitata* MERR. Philip. J. Sc. 17 (1920) 281; En. Philip. 3 (1923) 11; SUESSENG. *l.c.* — **Fig. 2.**

Treelet 1–5 (–8) m high, *c.* 1 cm ⌀. *Leaves* 1-pinnate, 3–5 clustered at the apex of the stem; leaflets 5–13. Petiole $2^1/_2$–11 cm; *stipules* obovate, up to $2^1/_2$ by $^1/_2$ cm, scar broadly triangular of similar length; rachis 13–30 cm. Leaflets elliptic to elliptic-oblong, (12–) 15–30 (–40) by (2–) 4–10 (–14) cm, glabrous, coriaceous; pearl glands sparse, globular-depressed; margin crenately toothed; apex acuminate; base obtuse to subcordate; nerves 10–14 pairs, sometimes pubescent. *Inflorescences* 3–5 cm long, condensed, glabrous; bracts deltoid to obtuse, inconspicuous; peduncle to $1^1/_2$ cm, main branches short usually, 3 ultimate branches highly condensed. *Flowers* 4-merous, greenish white. Calyx *c.* 5 by 5 mm, somewhat inflated around the corolla tube, lobes 1 by 2 mm. Corolla tube + staminodial lobes 6 mm long; corolla lobes $3^1/_2$ by $2^1/_2$ mm. Staminodial tube 5 mm long; upper free part $2^1/_2$–3 mm, lobes shallowly retuse, sinuses shallow; lower free part 2 mm. Filaments 2 mm, anthers 2 mm. Ovary 4--celled, style 2 mm. *Fruit* 10–15 mm ⌀, orange; seeds usually 4, 5–7 by 5 mm, rumination outline reticulate, endosperm complexly ruminate.

Distr. *Malesia*: Philippines: Luzon (Apayao, Aurora, Benguet, Laguna, Nueva Ecija, Tayabas), Polillo, Samar. Fig. 21.

Ecol. Primary lowland rain-forest to 500 m.

6. Leea philippinensis MERR. Philip. J. Sc. 1 (1906) Suppl. 89; *ibid.* 3 (1908) Bot. 419; En. Philip. 3 (1923) 13, *incl. var. pauciflora* (ELM.) MERR. *l.c.*; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 387; LIU, SASAKI & KENG, Quart. J. Taiw. Mus. 8 (1955) 306; HATUSIMA, Mem. Fac. Agr. Kagosh. Un. 5 (1966) 39; RIDSDALE, Blumea 22 (1974) 80, f. 2/3. — *L. pauciflora* ELM. Leafl. Philip. Bot. 8 (1919) 3103, *non* KING, 1896. — *L. nitida* MERR. Philip. J. Sc. 20 (1922) 406; En. Philip. 3 (1923) 13; SUESSENG. *l.c.* — **Fig. 2.**

Tree up to 10 m high. *Leaves* 1- (rarely 2- to 3-) pinnate; leaflets 5–15 (–∞). Petiole (2–) 3–8 (–11) cm; *stipules* a narrow wing (2–) 3–6 (–8) by $^1/_4$–$^1/_2$ cm; rachis $2^1/_2$–10 (–18) cm. Leaflets ovate to ovate-lanceolate or elliptic to elliptic-lanceolate, (3–) 6–20 (–30) by ($1^1/_2$–) 2–6 (–11) cm, glabrous, chartaceous to subcoriaceous; pearl glands stellate and globose, infrequent; drying colour often bluish grey-green above; margin shallowly crenate to repand, rarely dentate; apex acuminate; base rounded to acute; nerves 4–14 pairs; ultimate venation immersed and indistinct; petiolules 2–20 mm. *Inflorescences* 3–15 (–25) cm long, somewhat lax, glabrous or minutely pubescent particularly at the nodes; bracts deltoid to ovate, inconspicuous; peduncle 2–8(–14) cm, main branches numerous, laxly branched, ultimate branches reduced. *Flowers* 4-merous, cream. Calyx 3–4 by 4–5 mm, glabrous, lobes 1–2 by 2–3 mm. Corolla tube + staminodial lobes 5–6 mm; corolla lobes 3–4 by 2–3 mm. Staminodial tube $2^1/_2$–4 mm long; upper free part $1^3/_4$–3 mm long, lobes shallowly retuse, sinus shallow to $^1/_2$ mm; lower free part $^3/_4$–1 mm. Filaments 1–$1^3/_4$ mm, anthers 1.7–2 mm. Ovary 4-celled, style 1–2 mm. *Fruit* 10–15 mm ⌀, orange-brown; seeds usually 4, *c.* 6 by 6 mm, dark brown, rumination outline reticulate, endosperm complexly ruminate.

Distr. *Malesia*: Philippines: Batan Is., Luzon (Apayao, Aurora, Bataan, numerous collections from Lamao River, Benguet, Cagayan, Laguna, numerous collections from Mt Makiling, Nueva Ecija, Pangasinan, Rizal, Tayabas, Zambales), Mindoro (Occid., Orient.), Mindanao (Davao, Surigao, Zamboanga de Norte); Taiwan: Botel Tobago (= Orchid I.). Fig. 16.

Ecol. Primary rain-forest to 750 m.

7. Leea amabilis VEITCH [Catalogue (1882) 19, *nom. nud.*] *ex* MASTERS, Gard. Chron. 27 (1882) 492, f. 77; W. ROB. Garden 21 (1882) 352; LINDEN & RODRIGAS, Ill. Hort. 31 (1884) 59, t. 518, *incl. var. splendens*; HALL. *f.* Ann. Jard. Bot. Btzg 14 (1897) 241; ANON. Kew Bull. Add. Ser. IV (1900) 234; MERR. En. Born. (1921) 368; C. BONSTEDT, Parey's Blumengart. (1931) 895; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 385; RIDSDALE, Blumea 22 (1974) 80, f. 2/2, 5/8–10. — **Fig. 2, 7.**

Treelet up to 2 m high. *Leaves* 1-pinnate, leaflets 7–9. Petiole 8–16 cm; *stipules* a narrow wing 3–5 mm broad, 3–8 cm long, scar narrow, similarly long; rachis 10–25 cm. Leaflets elliptic to elliptic--lanceolate, (10–) 15–25 (–30) by (3–) 5–9 (–12) cm, glabrous; pearl glands globular-depressed, sparse; margins shallowly serrately toothed; apex acuminate; base cuneate; nerves 8–13 pairs, midrib conspicuously constricted at point of junction of lateral nerves; lamina pallid in region of midrib in some collections; petiolules up to 25 mm. *Inflorescences* 4–8 cm long, somewhat contracted, few-flowered, pubescent; bracts deltoid to narrowly triangular, up to 5 by 2 mm, early caducous; peduncle up to 2 cm, main branches 3–6, ultimate branches reduced in number. *Flowers* 5-merous,

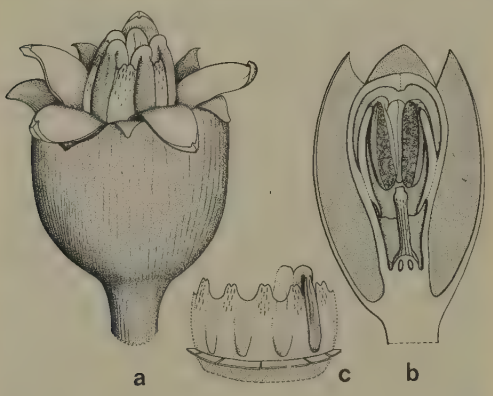

Fig. 7. *Leea amabilis* VEITCH *ex* MASTERS. *a.* Flower, *b. ditto* in LS, *c.* staminodial tube, the calyx, corolla, and stamens romoved, all × 5 (*a–c* KOSTERMANS 10605).

white. Calyx 4 by 6 mm, conspicuously inflated around the corolla tube, in young flowers enclosing the corolla, lobes *c.* 2 by 2 mm, often ill defined. Corolla tube + staminodial lobes 6 mm; corolla lobes 3–4 by $2^1/_2$–3 mm. Staminodial tube $4^1/_2$–5 mm long; upper part joined to corolla for $1^1/_2$–$2^1/_4$ mm, free part $1^3/_4$–2 mm long, lobes shallowly retuse, sinuses shallow; lower free part 1 mm. Filaments $2^1/_2$ mm, anthers $2^1/_2$ mm. Ovary usually 6-celled, style 2 mm. *Fruit* 15–20 mm ⌀, deeply grooved between segments; seeds usually 6, 6 by 5 mm, rumination outline simple, endosperm simply ruminate.

Distr. *Malesia*: West Borneo (Sarawak: ?Kuching area; Kalimantan: E. Kutei). Fig. 8.

Ecol. Primary lowland rain-forest, apparently rare.

Note. Originally described from a plant introduced into cultivation by VEITCH & Sons from a collection of CURTIS in Borneo. Independently collected by TEUSCHER and introduced into cultivation in Belgium via Comp. Contin. d'Hort. à Gand. No longer known to be cultivated in Europe.

8. Leea simplicifolia ZOLL. & MOR. Nat. Geneesk. Arch. N. I. 2 (1845) 578; MIQ. Fl. Ind. Bat. 1, 2 (1859) 612; Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 101; CLARKE, J. Bot. 19 (1881) 166; KING, J. As. Soc. Beng. 65, ii (1896) 411; BACKER, Schoolfl. Java (1911) 254; RIDL. Fl. Mal. Pen. 1 (1922) 483; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 393; BACKER & BAKH. *f.* Fl. Java 2 (1965) 93; RIDSDALE, Blumea 22 (1974) 81, f. 1/8, 10. — *L. pauciflora* KING, J. As. Soc. Beng. 65, ii (1896) 412; RIDL. Fl. Mal. Pen. 1 (1922) 483; CRAIB, Fl. Siam. En. 1 (1926) 319, *incl. var. ferruginea* CRAIB, *l.c.*; SUESSENG. *l.c.* 385. — *L. forbesii* BAKER *f.* J. Bot. 62 (1924) Suppl. 24; SUESSENG. *l.c.* 385. — **Fig. 2.**

Woody shrub up to 1 m, rootstock creeping. *Leaves* 1-foliolate, 3-foliolate or pinnate, leaflets 1–7. Petiole 4–18 cm; *stipules* a narrow wing 2–5 mm broad, 2–4 cm long; scar narrow, similarly long; rachis up to 25 cm. Leaflets, in 1-foliolate examples: elliptic to elliptic-oblong or obovate, (6–) 12–24 (–28) by (3–) 8–12 (–14) cm, in 3-foliolate and pinnate examples: elliptic to elliptic-lanceolate or ovate to ovate-lanceolate, (8–) 10–20 (–24) by (3–) 4–8 (–12) cm, glabrous, chartaceous to subcoriaceous; pearl glands stellate, infrequent; margin repand to dentate; apex acuminate; base rounded to cordate; nerves 9–14 pairs, usually 5-nerved at the base; petiolules up to 25 mm. *Inflorescences* up to 5 cm long, condensed, glabrous to sparsely pubescent; bracts deltoid to triangular, inconspicuous; peduncle 1–2 cm, main branches usually 3, ultimate branches condensed. *Flowers* 5-merous, white. Calyx *c.* $2^1/_2$ by $2^1/_2$ mm, lobes 1 by $1^1/_2$–2 mm. Corolla tube + staminodial lobes $1^3/_4$–2 (–$2^1/_2$) mm; corolla lobes 2–$2^1/_2$ by 1 mm. Staminodial tube 1–$1^1/_4$ mm long; upper free part 1 mm, lobes retuse, sinuses shallow; lower free part 0.3–0.5 mm. Filaments 1 mm, anthers $^1/_2$–1 mm. Ovary 4–6-celled, style 1 mm. *Fruit c.* 10 mm ⌀; seeds frequently only 1–3 by abortion, 6 by 4 mm, rumination outline simple, endosperm simply ruminate.

Distr. Thailand (Peninsular: Pattani); *Malesia*: Malaya (Kelantan, Perak), Sumatra (Atjeh, Tapanuli, Lampung), West and East Java. Fig. 8.

Ecol. Primary lowland forest to 800 m, particularly streamsides. Apparently rather rare.

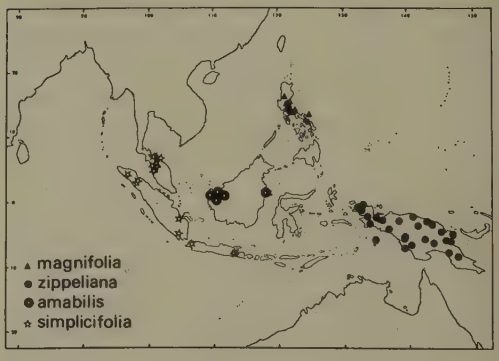

Fig. 8. Range of four *Leea* species.

9. Leea gonioptera LAUT. Nova Guinea 8 (1912) 832; *ibid.* 14 (1924) 138; Bot. Jahrb. 59 (1925) 529; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 388; RIDSDALE, Blumea 22 (1974) 81.

Undershrub up to 3 m. Young parts sometimes rusty pubescent. *Leaves* 1-foliolate or pinnate, leaflets 1–9. Petiole up to 6 cm long; *stipules* a narrow wing 2–5 mm wide, in 1-foliolate examples extending the length of the petiole, in pinnate examples 2–3 cm long; scar narrow, similarly long. Leaflets elliptic to elliptic-oblong, (3–) 8–27 (–35)

by (1½–) 2–5 (–9) cm, glabrous to sparsely pubescent, chartaceous; pearl glands black, globular-depressed, sometimes frequent; margin shallowly crenate to repand; apex (long-) acuminate; base subauriculate; nerves 6–20 pairs, glabrous to pubescent. *Inflorescences* to 4 cm, condensed, pubescent; bracts narrowly triangular, inconspicuous; peduncle to 1 cm, main branches usually 3, ultimate branches short, few-flowered. *Flowers* 5-merous, greenish white. Calyx 2½ by 2½ mm, pubescent, lobes 1 by 1½ mm. Corolla tube + staminodial lobes 3–4 mm; corolla lobes 2–3 by 1–1½ mm. Staminodial tube 2–2½ mm; upper free part 1–1½ mm, lobes shallowly retuse, sinuses shallow; lower free part ¾–1 mm. Filaments 1½ mm, anthers 1 mm. Ovary 4- or 5-celled, style 1–2 mm. *Fruit* 9–12 mm ∅; seeds usually (2) 3–5, *c.* 5 by 5 mm, rumination outline simple, endosperm simply branched.

Distr. *Malesia*: New Guinea (Vogelkop, Mimika and Digul Districts).

Ecol. Primary rain-forest to 500 m.

Note. A little known species represented by scant herbarium material. Unifoliolate specimens can not easily be distinguished from *L. zippeliana*, differing chiefly in the tapering leaflets with subauriculate base. Further collections are required to establish the species limits as the flowers in most of available material are immature.

10. Leea zippeliana MIQ. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 101; SCHEFF. Ann. Jard. Bot. Btzg 1 (1876) 16; F. v. M. Pap. Pl. 1 (1876) 37; CLARKE, J. Bot. 19 (1881) 166; LAUT. Bot. Jahrb. 59 (1925) 529, *incl. var. ornata* LAUT. *l.c.*; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 384, 388; RIDSDALE, Blumea 22 (1974) 81, f. 1/3. — *L. micholitzii* SANDERS, Cat. (1889) 20, *nom. nud.* — *L. monophylla* LAUT. Nova Guinea 8 (1910) 302; *ibid.* (1912) 832, *pro parte*; *ibid.* 14 (1924) 137; Bot. Jahrb. 59 (1925) 529; SUESSENG. *l.c.* 388. — **Fig. 2.**

Slender shrub or tree up to 7 m. Young parts sometimes rusty pubescent. *Leaves* 1-foliolate. Petiole 3–6 cm; *stipules* a narrow wing 3–5 mm wide extending the length of the petiole. Scar narrow, similarly long. Leaflets elliptic to elliptic-oblong, (10–) 14–25 (–38) by (3–) 7–10 (–13) cm, glabrous, chartaceous to subcoriaceous; pearl glands black, stellate, infrequent; margin shallowly toothed; apex acuminate; base narrowly cuneate to truncate; nerves 10–20 pairs, slightly pubescent. *Inflorescences* 2–6 cm, condensed, pubescent; bracts deltoid, inconspicuous; peduncle to 1½ cm, main branches usually 3, ultimate branches few-flowered. *Flowers* 5-merous, greenish yellow. Calyx 4 by 4 mm, lobes 1½ by 2 mm. Corolla tube + staminodial lobes 5 mm; corolla lobes 3½ by 2 mm. Staminodial tube 3–3½ mm; upper free part 2–2½ mm, lobes shallowly retuse, sinuses shallow; lower free part ¾–1 mm. Filaments 2 mm, anthers 2 mm. Ovary 4–6-locular, style 3–4 mm. *Fruit* 10–15 mm ∅, reddish orange; seeds usually 6, 8 by 5 mm, rumination outline slightly branched, endosperm simply ruminate.

Distr. *Malesia*: New Guinea (not yet recorded from Central, Northern and Milne Bay Districts). Fig. 8.

Ecol. Primary rain-forest from the lowland up to 1300 m, frequently in riverine forest, occasional in foothill forest, rare in savannah gallery forest.

11. Leea heterodoxa K. SCH. & LAUT. Fl. Schutzgeb. (1900) 431, *ex char.*; LAUT. Bot. Jahrb. 59 (1925) 530; RIDSDALE, Blumea 22 (1974) 81, f. ½. — *L. gigantea* K. SCH. & LAUT. Fl. Schutzgeb. (1900) 433, *non* GRIFF. 1864. — *L. tuberculata* LAUT. Nova Guinea 8 (1912) 832; Bot. Jahrb. 59 (1925) 533; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 388. — *L. rodatzii* LAUT. Bot. Jahrb. 59 (1925) 533; SUESSENG. *l.c.* — **Fig. 2.**

Treelets up to 3 m, stem and petiole base often ribbed and fluted. *Leaves* clustered at the stem apex, 1- to 3-pinnate. Petiole 6–35 cm; *stipule* half elliptic, *c.* 2–4 by 2 cm, glabrous, scar narrowly triangular, 2–3½ cm long; rachis 5–40 cm. Leaflets elliptic to elliptic-lanceolate or ovate to ovate-lanceolate, (8–) 14–28 (–38) by (4–) 5–8 (–12) cm, glabrous, chartaceous to coriaceous; pearl glands globose, infrequent; margin shallowly sinuate; apex acuminate; base rounded to cuneate, sometimes attenuate; nerves 6–8 on each side; petiolules 3–15 mm. *Inflorescences* to 5 cm long, condensed, glabrous or pubescent; bracts deltoid to triangular, up to 3 by 2 mm; peduncle to 2 cm long, main branches usually 3, short, ultimate branches reduced, often few-flowered. *Flowers* 5-merous, white. Calyx 3 by 4 mm, glabrous to pubescent; lobes 1 by 2 mm. Corolla tube + staminodial lobes 5 mm; corolla lobes 4 by 2 mm. Staminodial tube 3–4 mm long; upper free part 2–3 mm, lobes shallowly retuse, sinuses shallow, *c.* 0.3 mm; lower free part *c.* 1 mm. Filaments 1½ mm, anthers 3 mm. Ovary 6-celled, style 3 mm. *Fruit c.* 25 mm ∅, orange-brown; seeds usually 6, *c.* 10 by 7 mm, rumination outline complexly branched, endosperm semi-complex with an extra outgrowth on the lateral face.

Distr. *Malesia*: New Guinea (Vogelkop, Jayapura, West & East Sepik and Madang Districts). Fig. 13.

Ecol. Lowland rain-forests, often in ridge forest.

Notes. From the description and key of LAUTERBACH I cannot see sufficient characters to separate *L. heterodoxa* from *L. tuberculata*, an opinion inferred by LAUTERBACH himself (Bot. Jahrb. 59, 1925, 530 *in nota*). No extant type material of *L. heterodoxa* has been traced. Both taxa were only known from single collections at the time of LAUTERBACH.

12. Leea coryphantha LAUT. Nova Guinea 8 (1912) 832; Bot. Jahrb. 59 (1925) 530; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 388; RIDSDALE, Blumea 22 (1974) 81, f. 1/4–5, 8/2. — **Fig. 2, 4b.**

Understorey tree up to 7 m, stem often ribbed and fluted. *Leaves* clustered at the apex of the stem,

Fig. 9. *Leea papuana* MERR. & PERRY showing its unbranched habit (L. J. BRASS 7325, the type specimen — Photogr. L. J. BRASS).

(?1–) 2-pinnate. Petiole 10–50 cm; *stipules* half elliptic (3–) 5–9 by $1^1/_2$–$2^1/_2$ cm, scar narrowly triangular, similarly long; rachis 20–50 cm (or more). Leaflets ovate to ovate-oblong, (12–) 30–40 (–50) by (6–) 11–20 cm, glabrous, chartaceous to subcoriaceous; pearl glands globular, black, sparse; margin shallowly serrulate; apex acuminate; base obtuse, rarely cuneate; nerves (8–) 14–18 pairs; petiolules up to 2 cm, often winged and fluted. *Inflorescences* up to 25 cm long, then lax with few branches, usually to 6 cm and highly condensed, rusty pubescent when young; bracts deltoid to triangular; peduncle up to 13 cm, main and ultimate branches usually condensed, rarely with 3 main branches. *Flowers* 5-merous, white. Calyx $3^1/_2$–5 by $3^1/_2$–5 mm, lobes 1 by 2 mm. Corolla tube + staminodial lobes 5 mm; corolla lobes 3–4 by 2 mm. Staminodial tube $3^1/_2$–$5^1/_2$ mm; upper free part $2^1/_2$–$3^1/_2$ mm, lobes shallowly retuse, sinuses *c.* 1 mm deep; lower free part 1–2 mm. Filaments $1^1/_2$–2 mm, anthers $2^1/_2$–3 mm. Ovary 6–10-celled, style 3–4 mm. *Fruit* 20–25 (–40) mm ⌀, red with thick fleshy skin; seeds usually 6, 6–10 by 4–5 mm, rumination outline simple, endosperm semi-complex with an extra ingrowth on the lateral face.

Distr. *Malesia*: New Guinea (Vogelkop, West & East Sepik and Morobe Districts). Fig. 21.

Ecol. Primary rain-forest to 1500 m, often in riverine forest.

13. Leea papuana MERR. & PERRY, J. Arn. Arb. 22 (1941) 382; RIDSDALE, Blumea 22 (1974) 81, f. 1/1, 6/8–9. — *L. macropus* (*non* K. SCH. & LAUT.) BAKER *f.* J. Bot. 61 (1923) Suppl. 11; *ibid.* 62 (1924) 54. — **Fig. 2, 9, 10.**

Treelet up to 5 m, single- or multi-stemmed, ultimate parts of the stem glabrous to pubescent, sometimes slightly ribbed. *Leaves* 1- (or 2-) pinnate, clustered at the apex of the stem. Petiole 15–30 cm; *stipules* a narrow wing, 17–25 by $^3/_4$–1 cm, scar broad, similarly long; rachis 30–80 cm. Leaflets ovate-oblong to ovate-lanceolate, less frequently elliptic-oblong to elliptic-lanceolate, (15–) 20–30 (–45) by 6–20 cm, glabrous to densely pubescent; pearl glands depressed-globular, black, numerous; margin sinuate to shallowly dentate; apex acuminate; base obtuse to cuneate; nerves 8–20 pairs; petiolules up to 4 cm. *Inflorescences* 4–8 cm long, condensed, glabrous to pubescent; bracts narrowly triangular up to 8 by 3 mm; peduncle up to 2 cm, main branches short, ultimate branches few-flowered. *Flowers* 5-merous, orange-yellow. Calyx *c.* 7 by 7 mm, somewhat inflated around the corolla tube, glabrous, lobes $1^1/_2$–2 by 2–3 mm. Corolla tube + staminodial lobes 7–8 mm; corolla lobes 5–6 by $1^1/_2$–$2^1/_2$ mm. Staminodial tube 7–8 mm long; upper free part 3–4 mm, lobes deeply (1–$1^1/_2$ mm) strongly bifid, sinuses deep, *c.* 2 mm; lower part $2^1/_2$–$3^1/_2$ mm, appearing fused with corolla tube in material available. Filaments 3–4 mm, anthers 3–$3^1/_2$ mm. Ovary 6–8-celled, style 4–5 mm. *Fruit* 25–40 mm ⌀, orange-red; seeds usually 6, *c.* 15 by 6 mm, rumination outline complexly branched, endosperm semi-complex with extra ingrowth on the lateral face.

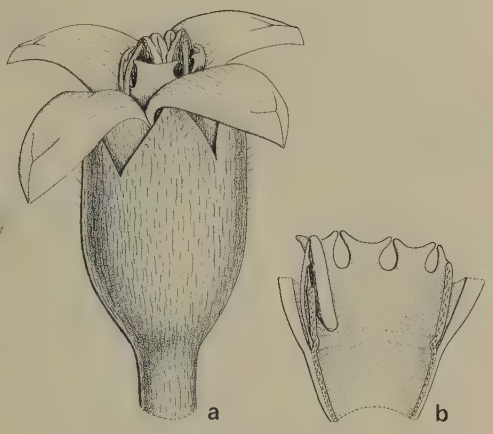

Fig. 10. *Leea papuana* MERR. & PERRY. *a.* Flower, *b.* LS showing interior of staminodial tube and insertion of one stamen, both × 5 (*a–b* FORBES PP 95).

Distr. *Malesia*: New Guinea: Papua (Western, Central, Northern, and Milne Bay Districts). Fig. 17.

Ecol. Lowland rain-forest to 1200 m, often in shaded riverine gullies.

14. Leea krukoffiana RIDSDALE, Blumea 22 (1974) 83, f. 7/4–7. — **Fig. 11, 12.**

Small tree up to 3 m. *Leaves* unequally 3–4-pinnate, leaflets numerous. Petiole 35 cm; *stipules* not seen, assumed to be a narrow wing, scar 20 cm long; rachis 55 cm. Leaflets ovate to ovate-oblong (4–) 8–14 by (2–) 3–5 cm, glabrous, chartaceous; pearl glands globular, sparse; margin sinuately toothed; apex acuminate; base obtuse to acute, sometimes unequal; nerves 4–9 pairs; petiolules 2–5 mm. *Inflorescences* multibranched, up to 10 cm long, lax, pubescent; bracts small, deltoid up to 2 mm long; peduncle 1 cm, main branches compact, ultimate branches short. *Flowers* 5-merous, pink. Calyx glabrous, 4 by 4 mm, lobes $1^1/_2$ by 2–$2^1/_2$ mm. Corolla tube + staminodial lobes $6^1/_2$–$7^1/_2$ mm; corolla lobes 5–6 by 2 mm. Staminodial tube $5^1/_2$ mm long; upper free part $3^1/_2$ mm, lobes shallowly retuse, sinuses shallow; lower free part 2 mm. Filaments 3 mm, anthers $2^1/_2$ mm. Ovary 6-celled, style 3 mm. *Fruit* unknown.

Distr. *Malesia*: New Guinea (Morobe Distr.: Kassam Pass), one collection. Fig. 13.

Ecol. Shaded forest gully, 1200 m.

Note. Named in honour of Dr B. A. KRUKOFF for his enthusiastic support of and interest in Malesian botany.

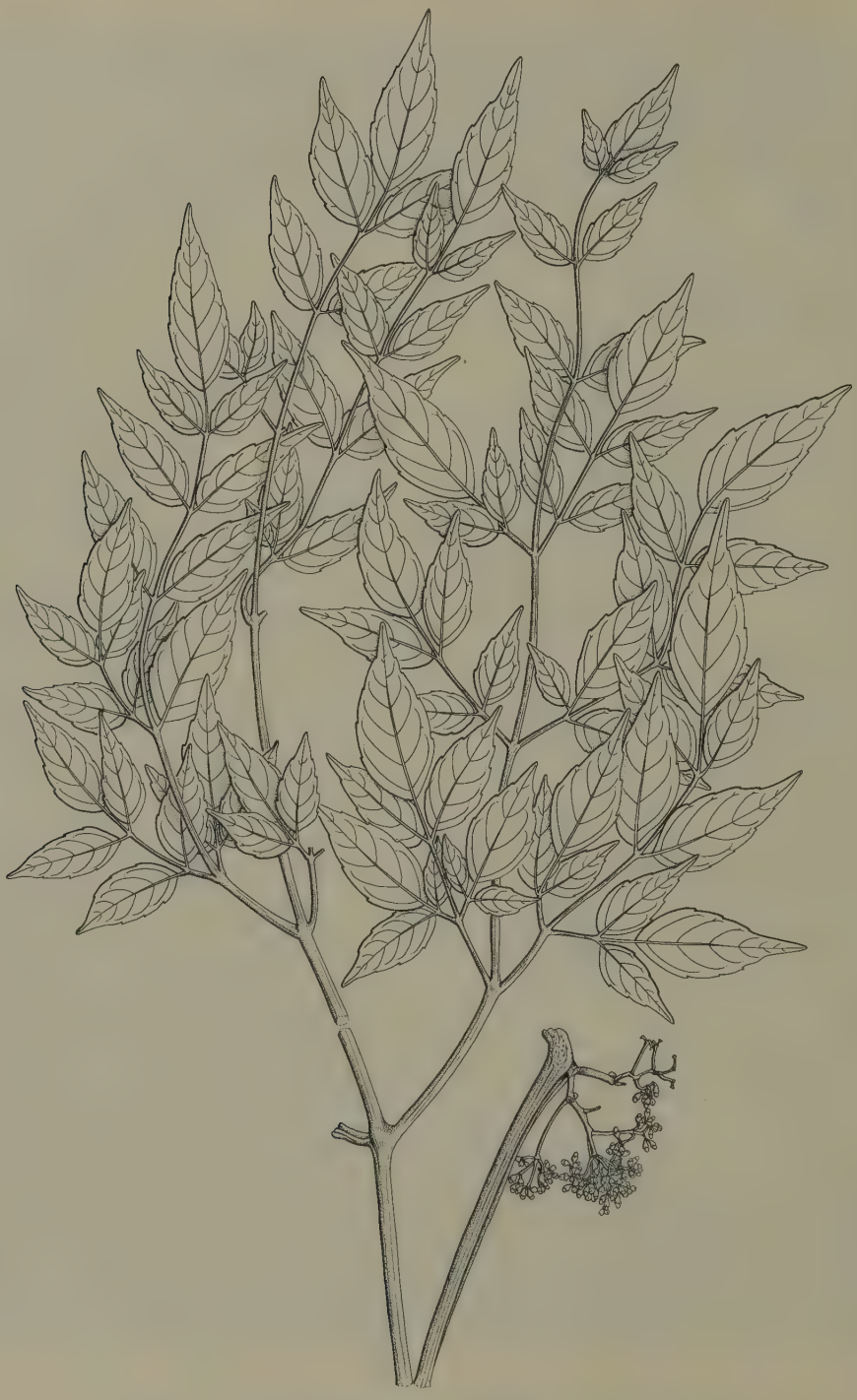

Fig. 11. *Leea krukoffiana* RIDSDALE. Habit, × 1/5 (NGF 37403).

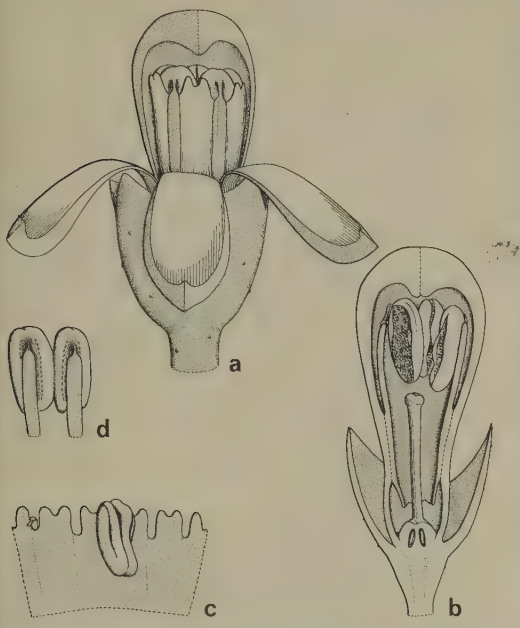

Fig. 12. *Leea krukoffiana* RIDSDALE. *a.* Flower, *b. ditto* in LS, *c.* inside of staminodial tube with one anther, *d.* two stamens, all × 5 (*a–d* NGF 37403).

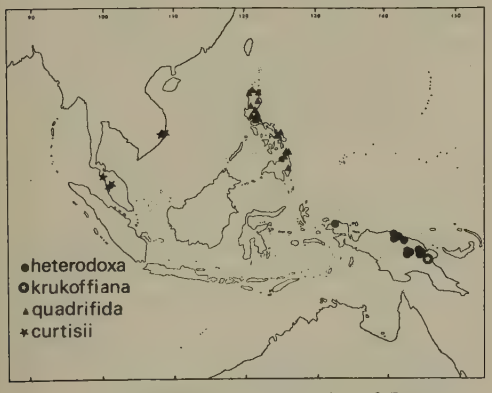

Fig. 13. Range of four species of *Leea*.

15. Leea macropus K. SCH. & LAUT. Notizbl. Berl.-Dahl. 2 (1898) 130; Fl. Schutzgeb. (1900) 430; Nachtr. (1905) 313; VAL. Ic. Bog. 3 (1908) 147, t. 258; LAUT. Bot. Jahrb. 59 (1925) 530; KANEH. & HATUS. Bot. Mag. Tokyo 52 (1938) 415; MERR. & PERRY, J. Arn. Arb. 22 (1941) 382; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 388, f. 104; RIDSDALE, Blumea 22 (1974) 83, f. 7/1–3. — **Fig. 14.**

Tree up to 15 m, often stilt-rooted. *Leaves* 1-pinnate, leaflets (5–) 7 (–9). Petiole 5–10 cm; *stipules* a narrow wing 3–5 mm broad extending the whole length of the petiole; scar narrow; rachis up to 50 cm. Leaflets elliptic to elliptic-oblong (-lanceolate or ovate-lanceolate), (8–) 15–30 (–35) by (5–) 7–12 (–15) cm, usually glabrous, rarely with sparse coarse hairs, subcoriaceous to coriaceous; pearl glands black, globose; margin sinuate to repand; apex acuminate; base rounded to obtuse; nerves 6–20 pairs; petiolules 5–25 mm long. *Inflorescences* (20–) 30–70 cm long, usually glabrous, (if pubescent then coarsely so and not fulvous), pendulous, lax; bracts deltoid, up to 2 mm long, inconspicuous; peduncle 5–20 cm, lateral branches of inflorescence long, ultimate branches somewhat spreading. *Flowers* 5-merous, cream. Calyx glabrous to sparsely pubescent, 3 by 4 mm, lobes $^1/_2$–1 mm. Corolla tube + staminodial lobes 8–11 mm long; corolla lobes 7–8 by 2 mm, usually glabrous. Staminodial tube 6–10 mm long; upper free part 6–9 mm, lobes retuse, sinuses shallow; lower free part $^1/_2$–1 mm. Filaments 5–7 mm, anthers 3–5 mm. Ovary 6-celled, style 4–6 mm. *Fruit c.* 30 mm ∅, red-orange; seeds usually 6, 10 by 5 mm, rumination outline simple, endosperm simply ruminate.

Distr. *Malesia*: Bismarck Archipelago (New Britain, New Ireland, Manus I.). Fig. 15.

Ecol. Understorey tree of primary forest, coastal plains and foothills to 500 m.

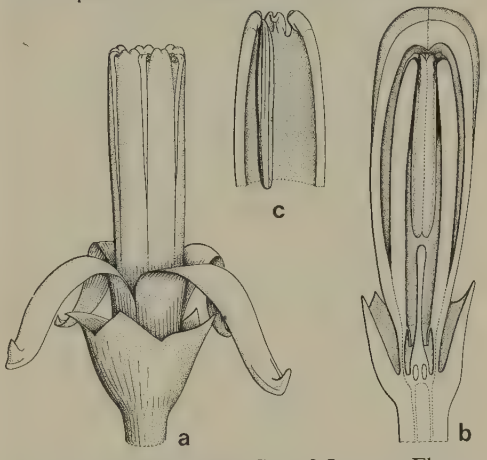

Fig. 14. *Leea macropus* K. SCH. & LAUT. *a.* Flower, *b. ditto* in LS, *c.* inside staminodial tube with one stamen, all × 5 (*a* KOSTERMANS 11199, *b–c* NGF 32599).

Fig. 15. Range of two species of *Leea*.

16. Leea tetramera BURTT, Kew Bull. (1935) 304; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 390; RIDSDALE, Blumea 22 (1974) 83, f. 1/6–7. — *L. solomonensis* MERR. & PERRY, J. Arn. Arb. 22 (1941) 380. — *L. suaveolens* MERR. & PERRY, *l.c.* 381. — **Fig. 3.**

Tree up to 15 m, flying buttresses sometimes present, up to $1^1/_2$ m high. Twigs and young parts usually minutely fulvously pubescent. *Leaves* 1- (or 2-)pinnate, leaflets 7–15. Petiole (3–) 5–10 cm; *stipules* a narrow wing 5–10 mm broad extending the length of the petiole; scar narrow; rachis (5–) 8–20 (–30) cm. Leaflets elliptic or narrowly ovate, (6–) 14–22 (–30) by (3–) 5–9 (–11) cm, usually glabrous, sometimes finely fulvously pubescent or with indumentum of coarse hairs, subcoriaceous to coriaceous; pearl glands globose, black, sometimes conspicuous; nerves 8–16 pairs; petiolules 5–25 mm. *Inflorescences* 13–35 cm long, when young usually finely fulvously pubescent, glabrous when older, pendulous, lax; bracts deltoid, up to 2 mm long, inconspicuous; peduncle 4–10 cm, main branches long, numerous, ultimate branches somewhat compact. *Flowers* 4- or 5-merous, sometimes both in one inflorescence, creamy white. Calyx usually pubescent, 4 by 4 mm, lobes $1^1/_2$–2 by $1^1/_2$–2 mm. Corolla tube + staminodial lobes 6–8 mm; corolla lobes 6 by 2 mm, usually pubescent. Staminodial tube *c.* 6 mm long; upper free part 4–$4^1/_2$ mm, lobes shallowly retuse, sinuses shallow; lower free part $1^1/_2$–2 mm. Filaments 3 mm, anthers 2 mm. Ovary 6-celled, style 3–4 mm, anthers 2 mm. Ovary 6-celled, style 3–4 mm. *Fruit* *c.* 30 mm ⌀, red-orange; seeds usually 6, *c.* 15 by 10 mm, rumination outline complexly branched, endosperm semi-complex with extra ingrowths on the lateral face.

Distr. Solomon Islands (Bougainville, Choiseul, New Georgia, Santa Isabel, Guadalcanal, Malaita, San Cristobel). Fig. 15.

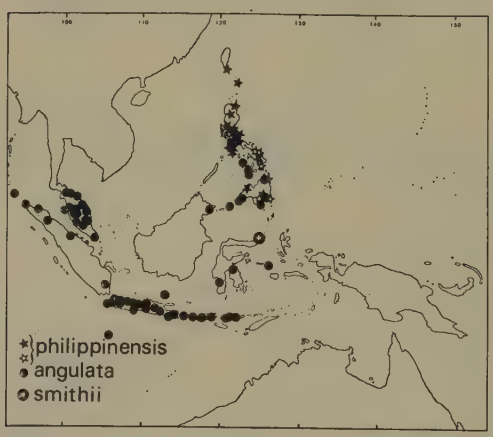

Fig. 16. Range of three species of *Leea*. Of *L. philippinensis* MERR. the solid stars refer to localities of specimens with 1-pinnate leaves, the open stars to those with 2-pinnate leaves.

Ecol. Understorey tree of primary forest; coastal plains, foothills, and ridges up to 600 m.

17. Leea angulata KORTH. *ex* MIQ. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 97; CLARKE, J. Bot. 19 (1881) 166; KING, J. As. Soc. Beng. 65, ii (1896) 414; K. & V. Bijdr. 9 (1903) 9; BACKER, Schoolfl. Java (1911) 255; RIDL. Fl. Mal. Pen. 1 (1922) 485; MERR. En. Philip. 3 (1923) 11; BURK. Dict. (1935) 1326; CORNER, Ways. Trees 1 (1940) 97; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 384, 385; BACKER & BAKH. *f.* Fl. Java 2 (1965) 94; RIDSDALE, Blumea 22 (1974) 84, f. 3/2–3, with full synonymy. — *L. horrida* T. & B. Cat. Hort. Bog. (1866) 169, *nom. nud.*; CLARKE, J. Bot. 19 (1881) 166; CERON, Cat. Pl. Herb. Manilla (1892) 51. — *L. aculeata* (*non* BL.) KURZ, J. As. Soc. Beng. 45, ii (1876) 124; CLARKE, J. Bot. 19 (1881) 105. — *L. sambucina* (*non* WILLD.) BAKER *f.* in Andrews, Monogr. Christmas I. (1900) 176. — *L. sambucina var. intermedia* RIDL. J. Str. Br. R. As. Soc. 45 (1906) 185. — **Fig. 3.**

Weak straggler, bushy shrub or tree up to 15 m, frequently multi-stemmed and suckering; trunk, main and ultimate branches with triangular thorns. *Leaves* 2- or 3-pinnate, leaflets numerous. Petiole 3–6 cm long; *stipules* a narrow wing 2–5 mm by $2^1/_2$–5 cm, usually extending the whole length of the petiole, scar narrow, similarly long; rachis (5–) 12–20 (–25) cm. Leaflets elliptic to elliptic-lanceolate or ovate to ovate-lanceolate, ($2^1/_2$–) 8–12 (–15) by ($1^1/_2$–) $2^1/_2$–$3^1/_2$ (–5) cm, glabrous; pearl glands globular, rarely seen; margin crenate, less frequently shallowly serrate; apex acuminate; base rounded to cuneate; nerves 4–10 pairs, often with hairy domatia, rarely sparsely pubescent along the whole length; petiolules up to 10 mm. *Inflorescences* up to 25 cm long, broad, multi-branched, pubescent; bracts triangular to narrowly triangular up to 3 by 2 mm; peduncle 4–10 cm long, main branches long, ultimate branches lax. *Flowers* 5-merous, greenish white. Calyx $2^1/_2$ by $2^1/_2$ mm, pubescent; lobes 1 by 1 mm. Corolla tube + staminodial lobes $3^1/_2$–4 mm long; corolla lobes 2–3 by 1–$1^1/_2$ mm. Staminodial tube $1^3/_4$–$2^1/_4$ mm long; upper free part $1^1/_4$–$1^1/_2$ mm, lobes retuse, sinuses shallow; lower free part $^1/_2$–$^3/_4$ mm, conspicuously thickened. Filaments $1^1/_2$ mm, anthers $1^1/_2$ mm. Ovary 6-celled, style 2 mm. *Fruit* 7–10 mm ⌀, greyish blue; seeds usually 6, *c.* 5 by 3 mm, rumination outline simple, endosperm simply ruminate.

Distr. Nicobar Is., Thailand (Peninsular: Songkhla, Pattani, Narathiwat); *Malesia*: Malaya (Kedah, Penang, Perak, Kelantan, Pahang, Selangor), Singapore, Sumatra (Atjeh, E. Coast, Lampong), Java (common, incl. Bawean and Christmas I.), Lesser Sunda Is. (Bali, Lombok, Sumbawa, Flores), N. Borneo (Sabah, Tawau), Philippines (Negros, Panay, Mindanao, Basilan, Sulu Is.), Celebes (SE. and SW. Peninsula), Moluccas (Sula Is.: Sanana). Fig. 16.

Ecol. Secondary vegetation, particularly sandy heaths and riverine forest, up to 1500 m.

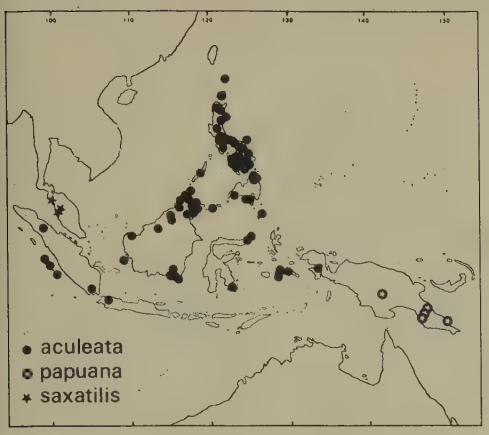

Fig. 17. Range of three species of *Leea*.

18. Leea aculeata BL. *ex* SPRENG. Syst. Veg. 1 (1824) 670; BL. Bijdr. 1 (1825) 197; SPRENG. Syst. Veg. 4, 2 (1827) Cur. post. 70; G. DON, Gen. Hist. 1 (1831) 713; STEUD. Nom. Bot. ed. 2, 2 (1840) 21; HASSK. Cat. Hort. Bog. (1844) 167; MIQ. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 99, *incl. var. moluccana* MIQ. *l.c.*; KOORD. Minah. (1898) 397; MERR. Philip. J. Sc. 2 (1907) Bot. 280; *ibid.* 3 (1908) Bot. 419; WINKLER, Bot. Jahrb. 44 (1910) 537; BACKER, Schoolfl. Java (1911) 254; MERR. Int. Rumph. (1917) 347; Sp. Blanc. (1918) 247; En. Born. (1921) 368; BROWN, Min. Prod. Philip. For. 3 (1921) 206; MERR. En. Philip. 3 (1923) 10; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 383; BACKER & BAKH. *f.* Fl. Java 2 (1965) 93; RIDSDALE, Blumea 22 (1974) 85, f. 3/5. — [*Frutex aquosus mas* RUMPH. Herb. Amb. 4 (1743) 102, t. 44.] — *Ticorea aculeata* BLANCO, Fl. Filip. (1837) 85. — *L. aculeata* (BLANCO) BLANCO, Fl. Filip. ed. 2 (1845) 127, *non* BL. *ex* SPRENG. 1824; NAVES, *ibid.* ed. 3, 1 (1877) 227, t. 306. — *L. serrulata* MIQ. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 99. — *L. angulata* (*non* KORTH.) KURZ, J. As. Soc. Beng. 45, ii (1876) 124; CLARKE, J. Bot. 19 (1881) 105. — *L. biserrata* (*non* MIQ.) NAVES in Blanco, Fl. Filip. ed. 3 (1877) t. 306. — *L. javanica* (*non* BL.) KOORD. Minah. (1898) 398. — *L. sandakanensis* RIDL. Kew Bull. (1931) 499; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 386. — **Fig. 3.**

Shrub to small tree up to 10 m, trunk and main branches with spines. *Leaves* 1-pinnate, leaflets (5–) 7 (–9). Petiole 2–6 cm; *stipules* a narrow wing, *c.* $^1/_2$ by (1–) 2–3 (?–4) cm, scar of similar length; rachis (3–) 6–12 (–15) cm. Leaflets elliptic to elliptic-oblong, occasionally ovate to ovate-oblong, (6–) 10–20 (–25) by ($2^1/_2$–) 4–6 (–10) cm, glabrous, subcoriaceous; pearl glands globose, black, infrequent; margin serrulate; apex long-acuminate; base rounded to cuneate; mature leaves with a characteristic yellowish-grey reticulate drying pattern; nerves 6–12 pairs; petiolules up to 2 cm. *Inflorescences* 7–20 cm long, broad and multi--branched; bracts deltoid to narrowly triangular up to 3 by $1^1/_2$ mm; peduncle 0–10 cm. *Flowers* 5-merous, greenish white. Calyx 3 by 3 mm, glabrous; lobes 2 by 1 mm. Corolla tube + staminodial lobes 4 mm long; corolla lobes 3 by $1^1/_2$–2 mm. Staminodial tube 3–$3^1/_2$ mm long; upper free part $1^1/_2$ mm, lobes slightly cleft, sinuses shallow; lower free part $1^1/_2$–$1^3/_4$ mm, extending downwards to the ovary (the upper portion of this lower part often thickened to form a conspicuous rim). Filaments $1^1/_4$ mm, anthers $1^1/_4$ mm. Ovary 4–6-celled, style 2 mm. *Fruit* 10–15 (–20) mm ⌀, shallowly grooved, blue-black; seeds usually 6, 6–12 by 3–6 mm, often less by abortion, rumination outline simple, endosperm simply ruminate.

Distr. *Malesia*: N. Sumatra (East Coast Res., Lampung, Mentawei and Nassau Is.), W. Java (rare; Karimata Is.), Borneo (SE. Kalimantan; Sarawak, 4 records; common in Sabah), Philippines (common), Celebes (N. and SE. Peninsulas), Moluccas (Talaud Is., Ceram, Ambon), New Guinea (Fakfak). Fig. 17.

A rather interesting distribution pattern with the species exceedingly common in the Philippines and Sabah but apparently very rare over the south-western part of its range to Sumatra.

Ecol. Wide-spread component of mainly secondary vegetation, particularly riverine areas, up to 1300 m, usually at lower altitudes.

Note. Unlike *L. angulata*, the spines in this species are found only on the trunk and main branches and are lacking on fertile shoots.

19. Leea curtisii KING, J. As. Soc. Beng. 65, ii (1896) 416; RIDL. Fl. Mal. Pen. 1 (1922) 485; BURK. Dict. (1935) 1326; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 385; RIDSDALE, Blumea 22 (1974) 85, f. 2/1. — *L. stipulosa* GAGNEP. Fl. Gén. I.-C. Suppl. (1950) 849, t. 106, *nom. inval.*; SUESSENG. *l.c.* 387. — **Fig. 3.**

Erect shrub, 1–4 m. *Leaves* 2-pinnate, leaflets numerous. Petiole *c.* 22 cm; *stipules* a narrow elongated wing $^1/_4$–$^1/_2$ by 5–10 (or more?) cm, scar of similar length; rachis *c.* 60 cm. Leaflets elliptic, 7–15 by 3–6 cm, glabrous; margins shallowly lobed to dentate; apex acuminate; base cuneate; nerves 4–10 pairs; petiolules 4–10 mm. *Inflorescences* 18–25 mm long, finely sparsely pubescent, lax, multi-branched; bracts deltoid, small; peduncle 6–9 cm. *Flowers* 5-merous, yellowish white. Calyx 3–4 by 3–5 mm, pubescent; lobes 1 by 2 mm. Corolla tube + staminodial lobes $3^1/_2$–$4^1/_2$ mm long. Staminodial tube $2^1/_2$–$4^1/_4$ mm; upper free part $1^1/_2$–$2^1/_4$ mm, lobes shallowly retuse, sinuses shallow; lower free part 1–2 mm. Filaments $1^1/_2$–$2^1/_4$ mm, anthers $1^1/_2$–2 mm. Ovary 6-celled, style 2 mm. *Fruit* unknown.

Distr. N. Vietnam (Nhatrang); *Malesia*: Malaya (Pahang, Perak). Only 4 collections. Fig. 13.

Ecol. Primary lowland forest.

Note. CURTIS noted: 'Leaves of very young plants partly masked with silvery grey variegation down either side of the midrib'. Introduced and cultivated in Penang Botanic Gardens, but has not

Fig. 18. *Leea aequata* L. *a*. Habit, *b*. young leaf with stipules, both × 1/3, *c*. venation with hairs and pearl glands, × 10 (*a*, *c* SCHIFFNER 2190, *b* BAKHUIZEN VAN DEN BRINK *f*. 4865).

been traced in the last 33 years and Mr K. C. CHANG considers it unlikely that it survives.

20. Leea aequata L. Syst. Nat. ed. 12, 2 (1767) 627 & Mantissa 1 (1767) 124; W. AIT. Hort. Kew. 1 (1789) 283; LAMK, Encycl. Méth. 3 (1792) 460; ROEM. & SCHULTES, Syst. Veg. 4 (1819) 705; SPRENG. Syst. Veg. 1 (1824) 670; G. DON, Gen. Hist. 1 (1831) 713; STEUD. Nom. Bot. ed. 2, 2 (1840) 21; KURZ, J. As. Soc. Beng. 44, ii (1875) 180; HEMSLEY, Rep. Chall. Exp. 1 (1885) 134; VIDAL, Rev. Pl. Vasc. Filip. (1886) 93; KING, J. As. Soc. Beng. 65, ii (1896) 419; COOKE, Fl. Pres. Bomb. 1 (1902) 261; PRAIN, Beng. Pl. (1903) repr. (1963) 239; USTERI, Beitr. Kenntn. Philip. Veg. (1905) 114; BRANDIS, Ind. Trees (1906) 179; TALBOT, For. Fl. Bomb. Pres. 1 (1909) 330; WINKLER, Bot. Jahrb. 44 (1910) 537; BACKER, Schoolfl. Java (1911) 256; GAGNEP. Fl. Gén. I.-C. 1 (1912) 940; GAMBLE & FISCH. Fl. Pres. Madras 1 (1918) 240; MERR. En. Born. (1921) 368; En. Philip. 3 (1923) 10; RIDL. Fl. Mal. Pen. 1 (1922) 486; HAINES, Bot. Bihar & Orissa 1 (1925) 209; COWAN & COWAN, Trees N. Beng. (1929) 40; BURK. Dict. (1935) 1326; KANJILAL & DAS, Fl. Assam 1 (1936) 307; CORNER, Ways. Trees 1 (1940) 97; GAGNEP. Fl. Gén. I.-C. Suppl. (1950) 848; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 385, 387, 388; HUNDLEY & U CHIT KO KO, List Tr. Shr. Herbs & Climb. Burma (1961) 54; BACKER & BAKH. *f.* Fl. Java 2 (1965) 94; HARA, Fl. E. Himal. (1966) 200; SUWAL, Med. Pl. Nepal (1970) 22; BURGER, Seedl. Trop. Tr. Shr. SE. Asia (1972) 379, f. 154; RIDSDALE, Blumea 22 (1974) 90, f. 3/12. — *Frutex aquosus femina* RUMPH. Herb. Amb. 4 (1743) 107, t. 45. — *L. hirta* ROXB. *ex* HORNEM. Hort. Hafn. 1 (1813) 231; ROXB. Hort. Beng. (1814) 18; Fl. Ind. ed. 1, 2 (1824) 469; DC. Prod. 1 (1824) 635; SPRENG. Syst. Veg. 1 (1824) 670; BL. Bijdr. 1 (1825) 196; G. DON, Gen. Hist. 1 (1831) 713; ROXB. Fl. Ind. ed. 2, 1 (1832) 656; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 446; STEUD. Nom. Bot. ed. 2, 2 (1840) 21; HASSK. Cat. Hort. Bog. (1844) 168; VOIGT, Hort. Sub. Calc. (1845) 30; MIQ. Fl. Ind. Bat. 1, 2 (1859) 612; DRURY, Handb. Fl. Ind. 1 (1864) 34; WATT, Dict. Ec. Prod. India 4 (1890) 617; HUNDLEY & U CHIT KO KO, List Tr. Shr. Herbs & Climb. Burma (1961) 55. — *L. scabra* ROXB. *ex* ROEM. & SCHULTES, Syst. Veg. 4 (1819) 814; STEUD. Nom. Bot. ed. 2, 2 (1840) 21. — *L. hirsuta* BL. *ex* SPRENG. Syst. Veg. 1 (1824) 670; BL. Bijdr. (1825) 197; HASSK. Cat. Hort. Bog. (1844) 167; MIQ. Fl. Ind. Bat. 1, 2 (1859) 612. — *L. anacolona* MIQ. Fl. Ind. Bat. 1, 2 (1859) 611; Sum. (1861) 202. — *L. kurzii* CLARKE, J. Bot. 19 (1881) 165; SUESSENG. *l.c.* 385. — *L. hispida* GAGNEP. Not. Syst. 1 (1910) 229; Fl. Gén. I.-C. 1 (1912) 939; *ibid.* Suppl. (1950) 847, pl. 25 f. 1–8; SUESSENG. *l.c.* 387. — **Fig. 18, 19.**

Shrub, treelet or less frequently small tree up to 10 m, young branches usually densely hairy. *Leaves* 1–3-pinnate, leaflets 5 to numerous. Petiole (5–) 8–14 (–20) cm; *stipules* oblong-obovate, $1^1/_2$–$4^1/_2$ by 3–6 (–10) cm, pubescent to densely hairy, scar

Fig. 19. *Leea aequata* L. Pearl glands on underside of leaf, stereoscan photographs, from top to bottom × 40, × 125, × 500 (SCHIFFNER 2190).

$1^1/_2$–$2^1/_2$ (–4) cm long, slightly shorter than the stipule; rachis 7–20 (–25) cm, petiole and rachis usually hairy. Leaflets ovate to ovate-lanceolate or elliptic to elliptic-lanceolate, (3–) 10–22 (–30) by ($1^1/_2$–) 4–8 (–12) cm, above glabrous to hairy, particularly over the nerves, below sparsely to densely hairy, chartaceous; pearl glands globular to discoidal, brown, large and conspicuous to naked eye (in rare cases absent from the leaflets); margins serrate; apex acuminate to long acuminate; base cuneate to truncate, sometimes subcordate or unequal; nerves (5–) 8–14 (–18) pairs, usually densely hairy; petiolules 5–15 (–25) mm, hairy. *Inflorescences* 4–14 (–20) cm long, rusty pubescent to hairy; bracts ovate, up to 8 by 5 mm, conspicuous; peduncle 1–4 (–8) cm, lateral and ultimate branches rather short, sometimes condensed. *Flowers* 5-merous, greenish white. Calyx 3–4 by 3–4 mm, glabrous to densely pubescent, usually with pearl glands; lobes 1 by 2 mm. Corolla tube + staminodial lobes $2^1/_2$–$4^1/_2$ mm; corolla lobes 2–$3^1/_2$ by 1–$1^1/_2$ mm. Staminodial tube $1^3/_4$–$2^1/_4$ mm long; upper free part $1^1/_2$–2 mm, lobes deeply notched, sinuses shallow, to $^1/_2$ mm; lower free part 0.2–0.4 mm. Filaments 1–$1^1/_4$ mm, anthers 1–$1^1/_4$ mm. Ovary 4–7-celled, style $1^1/_2$–$2^1/_2$ mm. *Fruit* 8–15 mm ⌀, orange-red, often drying pallid; seeds usually 5 or 6, 4–6 by 4–6 mm, rumination outline simple, endosperm simply ruminate.

Distr. India (Bombay, Mysore, Madras, Central Prov., Orissa, Bihar, Bengal, United Prov., Sikkim, Assam), Bhutan, Nepal, Bangladesh, Andaman Is., Upper & Lower Burma, Thailand, Cambodia, Laos, N. & S. Vietnam; *Malesia*: Malaya, Singapore, Sumatra, Java (also Madura I.), Lesser Sunda Is. (Sumba, Timor, Wetar), Borneo (Kalimantan: Bandjermasin, Butungan, W. Kutai; Sarawak; Sabah), Philippines (Bohol, Coron I., Negros, Panay, Mindanao), Celebes (NE. & SW.), Moluccas (Tanimbar, Kai). Fig. 6.

Ecol. Wide-spread, but scattered, in secondary vegetation, apparently rather rare in Malaya and Borneo, up to 1400 m but usually at lower altitudes.

21. Leea rubra BL. *ex* SPRENG. Syst. Veg. 1 (1824) 670; BL. Bijdr. (1825) 197; G. DON, Gen. Hist. 1 (1831) 712; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 445; STEUD. Nom. Bot. ed. 2, 2 (1840) 21; HASSK. Cat. Hort. Bog. (1844) 167; Pl. Jav. Rar. (1848) 453; MIQ. Fl. Ind. Bat. 1, 2 (1859) 610; Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 96, *incl. var. polyphylla* (MIQ.) MIQ. *et var. apiifolia* ZIPP. *ex* MIQ. *l.c.* 97; KURZ, J. As. Soc. Beng. 44, ii (1875) 180; Fl. Burma 1 (1877) 279; CLARKE, J. Bot. 19 (1881) 104; ENGL. Bot. Jahrb. 7 (1886) 465; KING, J. As. Soc. Beng. 65, ii (1896) 416; KOORD. Minah. (1898) 398, *incl. forma celebica* KOORD. *nom. nud.*; PRAIN, Beng. Pl. (1903) repr. (1963) 239; VAL. Bull. Dép. Agr. Ind. Néerl. 10 (1907) 31; LAUT. Nova Guinea 8 (1910) 302; GAGNEP. Fl. Gén. I.-C. 1 (1912) 939; MERR. En. Born. (1921) 396; RIDL. Fl. Mal. Pen. 1 (1922) 485; CRAIB, Fl. Siam. En. 1 (1926) 320; BURK. Dict. (1935) 1327; CORNER, Ways. Trees 1 (1940) 97; GAGNEP. Fl. Gén. I.-C. Suppl. (1950) 846; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 383, 387, 388; DUONG, Fl. Vietnam (1960) 266; BACKER & BAKH. *f.* Fl. Java 2 (1965) 94; CORNER & WATANABE, Ill. Guide Trop. Pl. (1969) 454; RIDSDALE, Blumea 22 (1974) 91, f. 3/10–11, 6/6–7. — *L. polyphylla* MIQ. Fl. Ind. Bat. 1, 2 (1859) 610. — *L. sanguinea* (*non* WALL.) KURZ, J. As. Soc. Beng. 42, ii (1873) 66, *pro parte*. — *L. coccinea* (*non* PLANCH.) KURZ, *ibid.* 44, ii (1875) 179. — *L. brunoniana* CLARKE, J. Bot. 19 (1881) 166; BAILEY, Queensl. Fl. 1 (1899) 284; SUESSENG. *l.c.* 383, *pro parte*; SPECHT, Rec. Am.-Austr. Sc. Exp. Arnhem Land 3 (1958) 257. — *L. linearifolia* CLARKE, J. Bot. 19 (1881) 165; GAGNEP. Fl. Gén. I.-C. 1 (1912) 943; *ibid.* Suppl. (1950) 851; SUESSENG. *l.c.* 383, 387. — **Fig. 3, 20.**

Small semi-herbaceous shrub up to 3 m. *Leaves* 2- to 4-pinnate, leaflets numerous. Petiole 2–8 (–15) cm long; *stipules* a narrow wing, 2–4 by 0.3–0.5 cm, scar rather broad, similarly long; rachis ($2^1/_2$–) 5–25 (–42) cm. leaflets ovate to ovate-oblong, less frequently elliptic to elliptic-lanceolate or linear-lanceolate, (2–) 4–8 (–14) by (0.3–) 1.5–4 (–6) cm, glabrous, or less frequently with small hairs along the nerves, chartaceous; pearl glands apparently absent from the leaflets; margin crenate to shallowly serrate; apex acute to shortly acuminate; base rounded to acute; nerves 5–10 pairs, sometimes with minute hairs; petiolules 2–5 (–10) mm, often winged. *Inflorescences* (4–) 8–14 (–16) cm long, rusty pubescent, generally compact; bracts deltoid-triangular, inconspicuous; peduncle 3–8 (–16) cm, main branches numerous, ultimate branches short. *Flowers* 5-merous, bright red. Calyx 2–$2^1/_2$ by $1^1/_2$–$2^1/_2$ mm, glabrous; lobes 1 by 1 mm. Corolla tube + staminodial lobes 2–3 mm; corolla lobes $1^1/_2$–$2^1/_2$ by $1^1/_2$ mm.

Fig. 20. *Leea rubra* BL. *ex* SPRENG. *a.* Flower, *b. ditto* in LS, both × 5 (*a–b* PULLEN 6703).

Staminodial tube 1.2–2 mm long; upper free part 1–$1^1/_4$ mm, lobes shallowly retuse or cleft, sinuses deep $^1/_2$–$^3/_4$ mm; lower free part 0.3–0.5 mm. Ovary 4–6-celled, style 1–2 mm. Filaments 1 mm, anthers 1 mm. *Fruit* 8–10 mm ⌀, dark red; seeds *c.* 4 by 4 mm, usually 6, rumination outline simple, endosperm simply ruminate.

Distr. India (Assam, Khasia, Bengal), Bangladesh, Burma, Thailand, Cambodia, Laos, N. & S.

Vietnam; *Malesia*: Malaya (incl. Penang), Singapore, S. Sumatra (Palembang), Java (incl. Madura I.), Lesser Sunda Is. (Sumbawa, Flores, Sumba, Timor), Borneo (SE. Kalimantan, Sabah), Philippines (Palawan), Celebes, Moluccas (Tanimbar, Kai), New Guinea (Papua: Western & Central Distr.); N. Australia. Fig. 21.

Ecol. Dry monsoon forest, savannah, and secondary vegetation, up to 500 m.

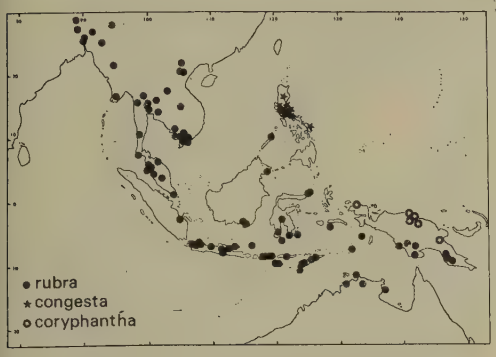

Fig. 21. Range of three *Leea* species.

22. Leea saxatilis RIDL. J. Str. Br. R. As. Soc. 75 (1917) 26; Fl. Mal. Pen. 1 (1922) 486; CRAIB, Fl. Siam. En. 1 (1926) 320; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 385; RIDSDALE, Blumea 22 (1974) 92, f. 3/4. — **Fig. 3.**

Small shrub up to 2 m. *Leaves* 1-pinnate, leaflets 9–13. Petiole (6–) 14–30 (–45) cm long; *stipules* a narrow wing 3–9 by 0.3–0.5 cm, scar narrow, similarly long; rachis 15–30 (–48) cm, ferruginously pubescent. Leaflets elliptic to elliptic-oblong, basal leaflets occasionally ovate, (10–) 15–21 (–25) by (3–) 5–7 (–9) cm, glabrous, chartaceous; pearl glands not seen; margin serrate to biserrate; apex acuminate; base obtuse to rounded (sometimes cuneate in apical leaflets); nerves (8–) 10–13 pairs, ferruginously pubescent; petiolules 3–15 mm. *Inflorescences* up to 8 (–12) cm long, condensed, ferruginously pubescent; bracts narrowly triangular up to 5 by 2 mm; peduncle up to 8 cm, lateral and ultimate branches of inflorescence highly condensed. *Flowers* 5-merous, red. Calyx 2 by 2 mm, pubescent; lobes 1 by 1 mm. Corolla tube + staminodial lobes 3 mm; corolla lobes 2 by $1^1/_2$ mm. Staminodial tube 3 mm long; upper free part $1^1/_4$–$1^1/_2$ mm, lobes retusely apiculate, sinuses shallow, to $^1/_2$ mm; lower free part $1^1/_2$ mm. Filaments 1 mm, anthers 1 mm. Ovary 6-celled, style 2 mm. *Fruit c.* 12 mm ∅, red; seeds usually 6, *c.* 5 by 4 mm, rumination outline simple, endosperm simply ruminate.

Distr. *Malesia*: Malaya (Perak, Selangor). Fig. 17.

Ecol. Shaded rocks and riverine areas, up to 500 m.

Note. A rarely collected species most probably related to *L. setuligera* CLARKE; further collections and field observations required.

23. Leea guineensis G. DON, Gen. Hist. 1 (1831) 712; HOOK. *f.* Niger Fl. (1849) 268; HUTCH. & DALZ. Fl. W. Trop. Afr. 1 (1928) 479, Appendix (1937) 304; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 388; RIDSDALE, Blumea 22 (1974) 92, f. 4/2–5, with full synonymy. — *L. arborea* TELF. *ex* W. & A. Prod. (1834) 132. — *L. manillensis* WALP. Nov. Act. Ac. Caes. Leop.-Car. 19 (1843) Suppl. 1: 314; Repert. 5 (1845) 378; VIDAL, Phan. Cuming. (1885) 104; Rev. Pl. Vasc. Filip. (1886) 94; MERR. Philip. J. Sc. 1 (1906) Suppl. 89; *ibid.* 3 (1908) Bot. 419; Fl. Manila (1912) 312; Sp. Blanc. (1918) 247; BROWN, Min. Prod. Philip. For. 3 (1921) 206; MERR. En. Philip. 3 (1923) 12; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 383; LIU, Illustr. Nat. Introd. Lign. Pl. Taiwan (1962) 851; LI, Woody Fl. Taiwan (1963) 524, f. 203. — *L. staphylea* (*non* ROXB.) WIGHT, Ill. Ind. Bot. 1 (1845) t. 58; Ic. Pl. As. 1 (1854) t. 78. — *L. aurantiaca* ZOLL. & MOR. Nat. Geneesk. Arch. N. I. 2 (1851) 577; MIQ. Fl. Ind. Bat. 1, 2 (1859) 612; BACKER & BAKH. *f.* Fl. Java 2 (1965) 94; BANERJEE & BABU, Ind. For. 97 (1971) 19. — *L. javanica* (*non* BL.) MIQ. Ann. Mus. Bot. Lugd.-Bat. 1 (1869) 100; VIDAL, Rev. Pl. Vasc. Filip. (1886) 93; MERR. Philip. Bur. For. Bull. (1903) 36; En. Born. (1921) 369; En. Philip. 3 (1923) 12. — *L. laetae* WALL. [Cat. (1832) *n.* 6831; STEUD. Nom. Bot. ed. 2, 2 (1849) 21; all *nom. nud.*] *ex* KURZ, J. As. Soc. Beng. 42, ii (1873) 65; *ibid.* 44, ii (1875) 179; Fl. Burma 1 (1877) 278; CLARKE, J. Bot. 19 (1881) 163; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 383. — *L. sanguinea* WALL. [Cat. (1832) *n.* 6824; BOJ. Hort. Maurit. (1837) 61; all *nom. nud.*] *ex* KURZ, J. As. Soc. Beng. 42, *ii* (1873) 66, *pro parte*. — *L. acuminata* WALL. [Cat. (1832) *n.* 6830; STEUD. Nom. Bot. ed. 2, 2 (1840) 21; KURZ, Rep. Veg. And. Isl. (1870) 34; all *nom. nud.*] *ex* CLARKE, J. Bot. 19 (1881) 141; J. Linn. Soc. Bot. 25 (1889) 13; KING, J. As. Soc. Beng. 65, ii (1896) 415; BRANDIS, Ind. Trees (1906) 179; BACKER, Schoolfl. Java (1911) 256; GAGNEP. Fl. Gén. I.-C. 1 (1912) 941; CRAIB, Aberd. Univ. Stud. 57 (1912) 43; HAINES, Bot. Bihar & Orissa 1 (1925) 207; CRAIB, Fl. Siam. En. 1 (1926) 316; COWAN & COWAN, Trees N. Beng. (1929) 40; KANJILAL & DAS, Fl. Assam 1 (1936) 304; GAGNEP. Fl. Gén. I.-C. Suppl. (1950) 851; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 383, 387; HUNDLEY & U CHIT KO KO, List Tr. Shr. Herbs & Climb. Burma (1961) 54; HARA, Fl. E. Himal. (1966) 199; Fl. E. Himal. 2nd Rep. (1971) 78. — *L. cumingii* CLARKE, J. Bot. 19 (1881) 166; ROLFE, J. Bot. 23 (1885) 211; VIDAL, Phan. Cuming. (1885) 104; Rev. Pl. Vasc. Filip. (1886) 94; MERR. En. Philip. 3 (1923) 11; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 383. — *L. wightii* CLARKE, J. Bot. 19 (1881) 105; JACKSON, Ind. Kew. 2 (1895) 48 ('*wrightii*'); BRANDIS, Ind. Trees (1906) 179; GAMBLE & FISCH. Fl. Pres. Madras 1 (1918) 239;

SUESSENG. *l.c.* 383. — *L. parva* ELM. Leafl. Philip. Bot. 1 (1908) 317; C. B. ROB. Philip. J. Sc. 6 (1911) Bot. 210; MERR. En. Philip. 3 (1923) 13; SUESSENG. *l.c.* 387. — *L. negrosense* ELM. Leafl. Philip. Bot. 2 (1908) 494; C. B. ROB. Philip. J. Sc. 6 (1911) Bot. 209; MERR. En. Philip. 3 (1923) 13; SUESSENG. *l.c.* 386. — *L. palawanensis* ELM. Leafl. Philip. Bot. 5 (1913) 1851. — *L. euphlebia* MERR. Philip. J. Sc. 9 (1915) Bot. 453; En. Philip. 3 (1923) 13; SUESSENG. *l.c.* 386. — *L. parvifoliola* MERR. Philip. J. Sc. 11 (1916) Bot. 145; En. Philip. 3 (1923) 13; SUESSENG. *l.c.* 386. — *L. papillosa* MERR. Philip. J. Sc. 13 (1918) Bot. 307; En. Philip. 3 (1923) 13; SUESSENG. *l.c.* 386. — *L. luzonensis* ELM. Leafl. Philip. Bot. 8 (1919) 3104. — *L. robusta* (*non* ROXB.) RIDL. Fl. Mal. Pen. 1 (1922) 486; CRAIB, Fl. Siam. En. 1 (1926) 320. — *L. dentata* CRAIB, Kew Bull. (1926) 357; Fl. Siam. En. 1 (1926) 317; GAGNEP. Fl. Gén. I.-C. Suppl. (1950) 846; SUESSENG. *l.c.* 386, 387. — *L. schomburgkii* CRAIB, Kew Bull. (1926) 358; Fl. Siam. En. 1 (1926) 321; GAGNEP. Fl. Gén. I.-C. Suppl. (1950) 855; SUESSENG. *l.c.* 387. — *L. brunoniana* (*non* CLARKE) LAUT. Bot. Jahrb. 63 (1930) 277; KANEHIRA, Bot. Mag. Tokyo 45 (1931) 295; Fl. Micronesia (1933) 208; J. Dep. Agr. Kyushu Imp. Univ. 4 (1936) 362. — *L. pallidifolia* KANEHIRA, Bot. Mag. Tokyo 49 (1935) 354; SUESSENG. *l.c.* 388. — *L. bulusanensis* ELM. Leafl. Philip. Bot. 10 (1939) 3801. — **Fig. 3.**

Shrub, sometimes with a creeping rootstock, or ± herbaceous branches, or tree 1–5 (–10) m; branches usually glabrous or finely pubescent, rarely densely hairy, villose or papillose. *Leaves* (1–) 2– or 3 (–4)-pinnate, leaflets numerous. Petiole (5–) 10–20 (–25) cm; *stipule* obovate, 2–4 (–6) by (1–) $1^1/_2$–3 cm, early caducous, glabrous, sparsely pubescent to woolly; scar broadly triangular (1–) 2–3 (–4) cm long, slightly shorter than the stipule; rachis (10–) 25–75 (–100) cm. Leaflets (broadly) ovate to ovate-lanceolate or (broadly) elliptic to elliptic-lanceolate, (3–) 8–20 (–30) by ($1^1/_2$–) 3–8 (–14) cm, rarely irregularly incised, above usually glabrous, rarely sparsely hairy to hispid, below glabrous to sparsely pubescent, rarely densely pilose or hispid, chartaceous to subcoriaceous; pearl glands globoid, small, rapidly caducous; margin repand to denticulate; apex (long-)acuminate; base cuneate to rounded, less frequently truncate or unequal; nerves (4–) 6–10 (–18) pairs, often with hairy domatia; petiolules (2–) 6–12 (–20) mm, glabrous or pubescent. *Inflorescences* (3–) 10–25 (–40) cm long, compact to lax, less frequently condensed, rusty pubescent, less frequently glabrous or hairy, rarely woolly; bracts ovate to deltoid to narrowly triangular, up to 3 mm long; peduncle (1–) 3–10 (–25) cm, lateral and ultimate branches long and spreading, or ultimate branches condensed. *Flowers* 5-merous, red to reddish orange, staminal tube red to citrous white. Calyx 1–3 by 2–4 mm, glabrous or pubescent; lobes 1–2 by 1–2 mm. Corolla tube + staminodial lobes (2–) 3–5 mm long; corolla lobes 2–4 by 1–$2^1/_2$ mm. Staminodial tube ($1^1/_4$–) 2–3 mm long; upper free part (1–) $1^1/_2$–$2^1/_2$ mm, lobes shallowly retuse, notched or cleft, sometimes continuing growth to appear apiculate, sinuses thin, shallow 0.2–0.6 mm; lower free part (0.2) 0.5–1.25 mm. Filaments $^1/_2$–$1^1/_4$ mm, anthers $^3/_4$–2 mm. Ovary (4–) 6 (–8)-celled, style 1–$2^1/_2$ mm. *Fruit* 5–15 mm ∅, red; seeds usually 6, *c.* 5 by 4 mm, rumination outline simple, endosperm simply ruminate.

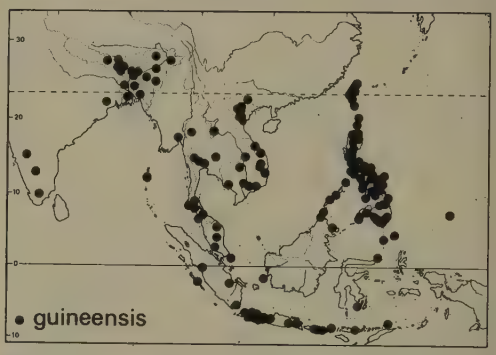

Fig. 22. Range of *Leea guineensis* G. DON in Indo-Malesia; the localities in Africa and the Malagasian area are omitted.

Distr. Tropical Africa; Madagascar, Bourbon, Mauritius; Asia: India (Madras to Assam), Burma, Thailand, Cambodia, Laos, Andaman Is., southwards becoming very rare; in *Malesia*: Malaya, Sumatra, Java, Lesser Sunda Is. (apparently absent from Borneo), Philippines (common), N. Celebes (rare); further in Taiwan and Micronesia (Palau). Fig. 22.

Ecol. In the Philippines, Taiwan and Micronesia replacing *L. indica* as the wide-spread component of secondary regrowth vegetation, but also found in primary forest; throughout the remainder of Malesia, a rather rare shrub of primary forest and shaded localities, in the area India to Vietnam and also in Africa it is once more a common component of secondary vegetation. From sea-level up to 1500 m, in the Himalayas ascending to 2250 m.

Notes. In the present circumscription the species shows a wide range of variability, both geographically and ecologically. It is undoubtedly a complex species composed of overlapping entities which cannot be satisfactorily delimited from each other, these entities sometimes having different ecological preferences. Previous workers, particularly in the Philippines have created many small segregate species, which can no longer be maintained as with increased material available all degrees of intermediates are found to exist. Most of these taxa were separated only by minor vegetative differences. The conclusion that there is but one variable species in Asia and Malesia independently concurs with that reached by GAGNEPAIN (1910) in his essay on the classification of the Asiatic species of *Leea* and that of BANERJEE

& BABU (1971) on the conspecificity of *L. aurantiaca* and *L. acuminata*. Comparison of the African and Asiatic material of '*L. guineensis*' and '*L. manillensis sensu lato*' showed that no clear cut differences could be found in herbarium material other than vague suggestions from the field notes that the colour of the staminodial tube might be different in living material; morphological characters of the leaves and flowers completely overlap.

Within the Asiatic perimeters of the variability there are clearly two ecological forms, one of shaded forest occurring in Malaya, Sumatra and Java, the other of secondary vegetation occurring in mainland Asia and in the Philippines. Within the latter area a vast range of forms is encountered and here the taxon appears to replace *L. indica* as a member of secondary vegetation.

Several morphological trends are apparent but none is clearly demarcated from the parent stock. Of these the entity '*L. manillensis*' commonly occurs from Taiwan to the Philippines. It is characterized by small leaf dimensions and usually by the presence of hairy domatia. However, all degrees of intermediates are to be found between this entity and '*L. negrosense*' with leaflets which are larger and somewhat coriaceous, or glabrous or sparsely pubescent. The most distinctive entity has woolly hairy stems and setaceous to hispid hairs on the upper leaf surface, this may be a semi-stable form within the Philippines, but again intermediates exist with the parent population. Previously this entity was given specific rank as '*L. cumingii*'. There is a parallel form from the Solomon Islands in the *L. indica* complex. The Indian material shows a less wide range of variation, but in the area Thailand to Vietnam a further morphological leaf form occurs which may well be an expression of an edge of range effect. The interrelationships of these different leaf forms can only be further resolved by ecological and population studies.

24. Leea indica (BURM. *f.*) MERR. Philip. J. Sc. 14 (1919) 245; En. Born. (1921) 368; En. Philip. 3 (1923) 11; CRAIB, Fl. Siam. En. 1 (1926) 318; CORNER, Ways. Trees 1 (1940) 97, Atlas pl. 1; MERR. & PERRY, J. Arn. Arb. 22 (1941) 380; SANTAPAU, Rec. Bot. Surv. Ind. 16 (1953) 56; PARHAM, Pl. Fiji Isl. (1964) 154; BANERJEE, Rec. Bot. Surv. Ind. 19 (1965) 33; CORNER & WATANABE, Ill. Guide Trop. Pl. (1969) 454; RIDSDALE, Blumea 22 (1974) 95, f. 4/6–8, 5/1–7, 8/5. — *Staphylea indica* BURM. *f.* Fl. Ind. (1768) 75, t. 23, f. 2. — *Aquilicia sambucina* L. Mantissa 2 (1771) 211; CAV. Dissert. 7 (1789) 372, t. 218 — *Aquilicia otillis* GAERTN. Fruct. 1 (1788) 275. — *Otillis zeylanica* GAERTN. *l.c.* t. 57, *nomen.* — *L. sambucina* WILLD. Sp. Pl. 1 (1789) 1177; ROXB. Hort. Beng. (1814) 18; ROEM. & SCHULTES, Syst. Veg. 4 (1819) 705; DC. Prod. 1 (1824) 635; SPRENG. Syst. Veg. 1 (1824) 670; ROXB. Fl. Ind. ed. 1, 2 (1824) 470; G. DON, Gen. Hist. 1 (1831) 712; ROXB. Fl. Ind. ed. 2, 1 (1832) 657; HASSK. Cat. Hort. Bog. (1844) 168; VOIGT, Hort. Sub. Calc. (1845) 30; HASSK. Pl. Jav. Rar. (1848) 453; A. GRAY, Bot. Wilkes U.S. Expl. Exp. (1854) 274; GRIFF. Not. Pl. As. 4 (1854) 698; Ic. Pl. As. 4 (1854) t. 644; MIQ. Fl. Ind. Bat. 1, 2 (1859) 611; Sum. (1861) 202; Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 99, *incl. var. sumatrana* (MIQ.) MIQ., *var. biserrata* (MIQ.) MIQ., *var. heterophylla* MIQ., *var. robusta* MIQ. *et var. simplex* MIQ. *l.c.*; BENTH. Fl. Austr. 1 (1863) 451; SEEM. Fl. Vit. (1865) 44; KURZ, Rep. Veg. And. Isl. (1870) 34; BRANDIS, For. Fl. (1874) 102; LAWS. Fl. Br. Ind. 1 (1875) 666, *pro parte*; KURZ, J. As. Soc. Beng. 44, ii (1875) 179; SCHEFF. Ann. Jard. Bot. Btzg 1 (1876) 15; F. v. M. Descr. Not. 1 (1876) 36; KURZ, J. As. Soc. Beng. 45, ii (1876) 124; Fl. Burma 1 (1877) 279; F.-VILL. Nov. App. (1880) 50; CLARKE, J. Bot. 19 (1881) 139, *incl. var. occidentalis* CLARKE, *l.c.* 140; HOME, Year in Fiji (1881) 264; VIDAL, Sinopsis (1883) 21, t. 33, f. 1; Phan. Cuming. (1885) 104; Rev. Pl. Vasc. Filip. (1886) 94; K. SCHINZ, Bot. Jahrb. 9 (1888) 208; WARB. Bot. Jahrb. 13 (1891) 368; TRIM. Fl. Ceyl. 1 (1893) 297; K. SCHINZ, Notizbl. Berl.-Dahl. 1 (1895) 53; HEMSL. Kew Bull. (1895) 134; KING, J. As. Soc. Beng. 44, ii (1896) 414; BAILEY, Queensl. Fl. 1 (1899) 284; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 430; COOKE, Fl. Bomb. 1 (1902) 260; TALBOT, Trees Shrubs Bomb. Pres. ed. 2 (1902) repr. (1949) 154; PRAIN, Beng. Pl. (1903) repr. (1963) 239; K. & V. Bijdr. 9 (1903) 8; DUTHIE, Upper Gangetic Pl. 1 (1903) 176; WILLIAMS, Bull. Herb. Boiss. II, 5 (1905) 217; BRANDIS, Ind. Trees (1906) 179; MERR. Philip. J. Sc. 1 (1906) Suppl. 89; VAL. Bull. Dép. Agr. Ind. Néerl. 10 (1907) 31; MERR. Philip. J. Sc. 3 (1908) Bot. 80; WINKLER, Bot. Jahrb. 44 (1909) 537; TALBOT, For. Fl. Bomb. Pres. 1 (1909) 327; HAINES, For. Fl. Chota Nagpur (1910) 280; LAUT. Nova Guinea 8 (1910) 302; BACKER, Schoolfl. Java (1911) 256; RIDL. J. Str. Br. R. As. Soc. 59 (1911) 87; *ibid.* 61 (1912) 51; GAGNEP. Fl. Gén. I.-C. 1 (1912) 941; LAUT. Nova Guinea 8 (1912) 831; RECHINGER, Denkschr. Kais. Ak. Wiss. Wien 89 (1914) 574; GIBBS, J. Linn. Soc. Bot. 42 (1914) 65; SCHMIDT, Bot. Tidsskr. 32 (1915) 330; GAMBLE & FISCH. Fl. Pres. Madras 1 (1918) 240; RIDL. Fl. Mal. Pen. 1 (1922) 484, *non* fig. 48; WHITE, Proc. R. Soc. Queensl. 34 (1923) 43; LAUT. Nova Guinea 14 (1924) 138; Bot. Jahrb. 59 (1925) 531; HAINES, Bot. Bihar & Orissa 1 (1925) 208; WHITE, J. Arn. Arb. 10 (1929) 237; COWAN & COWAN, Trees N. Beng. (1929) 40; KANJILAL & DAS, Fl. Assam 1 (1936) 307; GAGNEP. Fl. Gén. I.-C. Suppl. (1950) 848; CHITTENDEN, Dict. Gard. 3 (1951) 1143, *incl. var. roehrsiana* (SANDERS) CHITTENDEN; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 384, 385, 387, 388; BACKER & BAKH. *f.* Fl. Java 2 (1965) 94; BURGER, Seedl. Trop. Tr. Shr. SE. Asia (1972) 381, f. 155. — *L. sambucifolia* SALISB. Prod. (1796) 317. — *L. staphylea* ROXB. [Hort. Beng. (1814) 18, *nom. nud.*] Fl. Ind. ed. 1, 2 (1824) 471, *nom. illeg.*; SPRENG. Syst. Veg. 1 (1824) 670; *ibid.* 4, 2 (1827) Cur. post. 70; G. DON, Gen. Hist. 1 (1831) 712; ROXB. Fl. Ind. ed. 2, 1 (1832) 658; W. & A. Prod. (1834) 132; GRAHAM, Cat. Pl. Bomb. Vic. (1839) 33; VOIGT, Hort. Sub. Calc. (1845) 30; THW. En. Pl. Zeyl. (1859) 64; DALZ. & GIBS. Bomb. Fl.

(1861) 41; DRURY, Handb. Ind. Fl. 1 (1864) 181. — *L. otillis* (GAERTN.) DC. Prod. 1 (1824) 636; MOON, Cat. Pl. Ceyl. (1824) 18. — *L. robusta* BL. Bijdr. (1825) 198, *non* ROXB. *ex* HORNEM. 1813; SPRENG. Syst. Veg. 4, 2 (1827) Cur. post. 70; HASSK. Cat. Hort. Bog. (1844) 168. — *L. gigantea* GRIFF. Not. Pl. As. 4 (1854) 697; Ic. Pl. As. 4 (1854) t. 645, f. 2; KURZ, J. As. Soc. Beng. 42, ii (1873) 65; *ibid.* 44, ii (1875) 178; Fl. Burma 1 (1877) 280; CLARKE, J. Bot. 19 (1881) 140; KING, J. As. Soc. Beng. 65, ii (1896) 412; BRANDIS, Ind. Trees (1906) 179; RIDL. Fl. Mal. Pen. 1 (1922) 484, f. 48; CRAIB, Fl. Siam. En. 1 (1926) 317; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 384, 385; HUNDLEY & U CHIT KO KO, List Tr. Shr. Herbs & Climb. Burma (1961) 55. — *L. viridiflora* PLANCH. Hort. Donat. (1854) 6; SUESSENG. *l.c.* 384. — *L. sundaica* MIQ. Fl. Ind. Bat. 1, 2 (1859) 610; Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 96, *incl. var. fuliginosa* (MIQ.) MIQ., *var. subsessilis* MIQ. *et. var. pilosiuscula* MIQ. *l.c.*; F.v.M. Descr. Not. 1 (1876) 37; SCHEFF. Ann. Jard. Bot. Btzg 1 (1876) 15; WARB. Bot. Jahrb. 13 (1891) 369; BACKER, Schoolfl. Java (1911) 256; RIDL. Trans. Linn. Soc. Lond. II, Bot. 9 (1916) 32; MERR. En. Born. (1921) 369; RIDL. Fl. Mal. Pen. 1 (1922) 485; LAUT. Bot. Jahrb. 59 (1925) 534; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 385, 388; BACKER & BAKH. *f.* Fl. Java 2 (1965) 94. — *L. sumatrana* MIQ. Fl. Ind. Bat. 1, 2 (1859) 611; Sum. (1861) repr. (1862) 202. — *L. divaricata* T. & B. Cat. Hort. Bog. (1860) 388, *nom. nud.* — *L. biserrata* MIQ. Sum. (1861) repr. (1862) 518. — *L. fuliginosa* MIQ. *l.c.* 518. — *L. palembanica* MIQ. *l.c.* 203, 519. — *L. pubescens* ZIPP. *ex* MIQ. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 97; WARB. Bot. Jahrb. 13 (1891) 369; LAUT. Bot. Jahrb. 59 (1925) 534; SUESSENG. *l.c.* 388. — *L. celebica* CLARKE, J. Bot. 19 (1881) 166; SUESSENG. *l.c.* 384. — *L. umbraculifera* CLARKE, J. Bot. 19 (1881) 141; BRANDIS, Ind. Trees (1906) 179; COWAN & COWAN, Trees N. Beng. (1929) 40; KANJILAL & DAS, Fl. Assam 1 (1936) 306; SUESSENG. *l.c.* 384; HARA, Fl. E. Himal. (1966) 200; *ibid.* 2nd Rep. (1971) 79. — *L. brunoniana* (*non* CLARKE) ENGL. Bot. Jahrb. 7 (1886) 460; K. SCH. Bot. Jahrb. 9 (1888) 208; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 430; LAUT. Bot. Jahrb. 59 (1925) 530. — *L. naumannii* ENGL. Bot. Jahrb. 7 (1886) 466; K. SCH. Bot. Jahrb. 9 (1888) 208; Notizbl. Berl.-Dahl. 2 (1898) 130; SUESSENG. *l.c.* 388. — *L. javanica* (*non* BL.) KING, J. As. Soc. Beng. 65, ii (1896) 418; K. & V. Bijdr. 9 (1903) 12; BACKER, Schoolfl. Java (1911) 255; CRAIB, Aberd. Univ. Stud. 57 (1912) 43; RIDL. Fl. Mal. Pen. 1 (1922) 486; CRAIB, Fl. Siam. En. 1 (1926) 318; GAGNEP. Fl. Gén. I.-C. Suppl. (1950) 853; BACKER & BAKH. *f.* Fl. Java 2 (1965) 94. — *L. roehrsiana* SANDERS [Cat. (1899) 21, *nom. nud.*] *ex* MASTERS, Gard. Chron. III, 23 (1898) 242, f. 92; BONSTEDT in Parey's Blumengart. (1931) 895. — *L. novoguineensis* VAL. Bull. Dép. Agr. Ind. Néerl. 10 (1907) 31; LAUT. Bot. Jahrb. 59 (1924) 534; SUESSENG. *l.c.* 388. — *L. ramosii* MERR. Philip. J. Sc. 17 (1920) 282; En. Philip. 3 (1923) 14; SUESSENG. *l.c.* 386. — *L. gracilis* LAUT. Bot. Jahrb. 59 (1925) 532; SUESSENG. *l.c.* 388. — *L. expansa* CRAIB, Kew Bull. (1926) 358; Fl. Siam. En. 1 (1926) 317; GAGNEP. Fl. Gén. I.-C. Suppl. (1950) 852; SUESSENG. *l.c.* 386, 387. — *L. longifoliola* MERR. Lingn. Sc. J. 14 (1935) 33, f. 11; GAGNEP. Fl. Gén. I.-C. Suppl. (1950) 853; SUESSENG. *l.c.* 387. — **Fig. 3, 4e, 23.**

Shrub, treelet or small tree, 2–10 (–16) m, multi- or single stemmed, frequently stilt-rooted; stems glabrous to pubescent, rarely woolly or scabrously hairy or papillose or bristly. *Leaves* (1-) 2- or 3-pinnate, leaflets 7–∞. Petiole (6–) 10–25 (–35) cm long; *stipules* obovate, up to 6 by 4 cm, early caducous, usually glabrous to sparsely pubescent, rarely densely soft or bristly hairy, scar broadly triangular, 2– $3^1/_2$ (–5) cm long; rachis (6–) 10–35 (–60) cm, glabrous to pubescent, rarely soft or bristly hairy, or papillose. Leaflets (broadly ovate to ovate) ovate-oblong to ovate-lanceolate or (broadly) elliptic to elliptic-lanceolate, (4–) 10–24 (–45) by (1–) 3–12 (–20) cm, glabrous to hairy, rarely densely so, or woolly, chartaceous to subcoriaceous; pearl glands angular to somewhat globose, small, rapidly caducous; margins (crenate to) serrate to shallowly dentate; apex acute to acuminate; base cuneate to rounded (to subcordate); nerves (5–) 6–16 (–20) pairs; petiolules up to 25 mm, glabrous to hairy. *Inflorescences* (5–) 10–25 (–40) cm long, usually broad and lax,

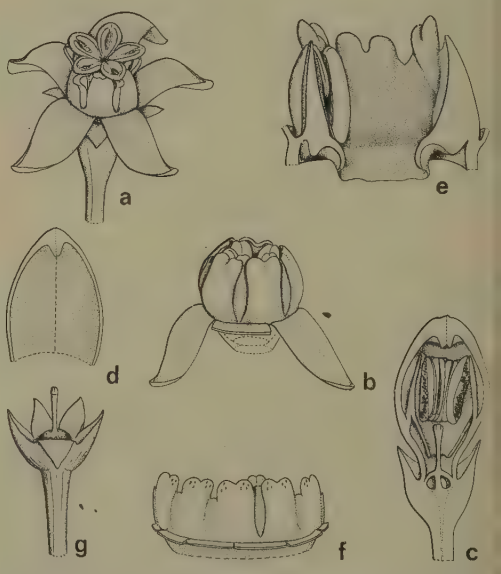

Fig. 23. *Leea indica* (BURM. *f.*) MERR. *a.* Flower, with elevated anthers, *b.* staminodial tube, filaments and apices of anthers, two petals, rest removed, *c.* flower in LS, *d.* corolla lobe from inside, *e.* staminodial tube from inside with one anther, *f. ditto* from outside with one stamen, *g.* calyx and pistil, all × 5 except *e* × 10 (*a* GEESINK 5946, *b–g* BSIP 14885).

rarely condensed, glabrous to pubescent, rarely soft or bristly hairy or papillose; bracts deltoid to narrowly triangular (to linear), up to 4 (–8) mm long; peduncle up to 15 cm, lateral and ultimate branches numerous and spreading, rarely highly condensed. *Flowers* 5-merous, greenish-white. Calyx ($1^1/_2$–) 2–3 by (2–) 3–4 mm, glabrous to pubescent, lobes 1–2 by 1–2 mm. Corolla tube + staminodial lobes $2^1/_2$–$3^1/_2$ mm; corolla lobes $2^1/_2$–$3^1/_2$ by $1^1/_2$–$2^1/_2$ mm. Staminodial tube ($1^1/_2$–) 2–$2^1/_2$ mm long; upper free part $1^1/_4$–2 mm; lobes shallowly retuse, notched (or cleft), sinuses shallow to 0.4 mm, rarely deep $^3/_4$–$1^1/_4$ mm; lower free part 0.2–0.5 mm. Filaments $^3/_4$–$1^1/_2$ mm, anthers 1–$1^1/_2$ mm. Ovary (4–) 6 (–8)-celled, style 1–$2^1/_2$ mm. *Fruit* 5–10 (–15) mm ∅, purple-black; seeds usually 6, *c.* 5 by 4 mm, rumination outline simple, endosperm simply ruminate.

Distr. Ceylon, India (from Madras and Bombay northwards to Punjab, Sikkim, Assam), Nepal, Bangladesh, Burma, Thailand, Cambodia, Laos, N. & S. Vietnam, China (Yunnan, Kwangsi, Hainan), Andaman and Nicobar Is.; in *Malesia*: Malaya, Singapore, Sumatra, Java, Lesser Sunda Is., Borneo, Philippines, Celebes, Moluccas, New Guinea (incl. Bismarck Archipelago); N. Australia, Solomon Is., Santa Cruz Is., New Hebrides (Espiritu Santo), Fiji (Vanau, Levu, Ovalau, Viti Levu, Kandavu, Moala), ?Tonga Is. Fig. 24.

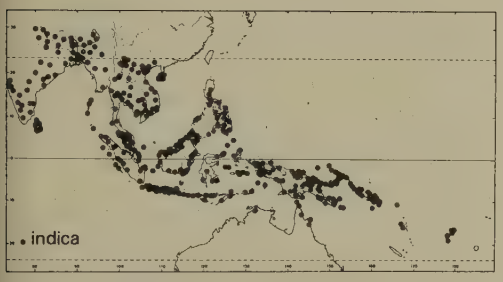

Fig. 24. Range of *Leea indica* (BURM. *f.*) MERR.; the locality of the Tonga Is. is uncertain.

Ecol. Wide-spread and common throughout the area, secondary forest and villages (often coppiced), primary forest, wet areas to ridges up to 1700 m, in the Himalayas ascending to 2500 m.

Notes. Many attempts have been made to segregate this common wide-spread species into smaller taxonomic units, particularly by MIQUEL who studied plants from the area where the greatest morphological diversity occurs. The majority of these segregates have been established on leaflet characters. One entity, somewhat distinctive in flower by the deep sinuses of the staminodial tube, occurs from Burma to Malaya together with the normal form of *L. indica*, overlapping in vegetative and other characters. It was considered to be specifically distinct by GRIFFITH, who described it as *L. gigantea*. The situation closely parallels that found in the Madagascan material of *L. guineensis* where the same deep sinuses occur. In *L. guineensis* this character occurs allopatrically in an insularly isolated population whilst in '*L. gigantea*' the character occurs sympatrically within the range of *L. indica*.

The remainder of the material shows rather interesting trends, particularly in leaf vestiture and dimensions. Within the area from India across to China and southward to Java the leaflets tend to be more or less glabrous and apparently have a trend to increase in size, culminating in large leaflet forms in Java. In the herbarium leaflets of all size classes may be found on plants from Java whilst, as far as can be ascertained, large leaflet forms do not occur in India. This trend is particularly apparent in the dimensions of the terminal leaflets. Eastwards across the Lesser Sunda Islands leaf pubescence tends to increase, culminating in very pubescent forms in New Guinea and the Bismarck Archipelago. The Solomon Islands have been very intensively collected and are relatively over-represented in the collections compared to other areas, but here all but two collections are more or less glabrous. Further eastwards to Fiji both pubescent and glabrous forms occur, but there is a decrease in the leaf size so that the glabrous form cannot be separated from the material from India or Ceylon.

The two specimens from the Solomon Is., BSIP 5371 (Rob Roy I.) and NGF 16378 (Bougainville), are unusual in having very large leaflets (*c.* 25 by 12 cm) which are hairy on the nerves, whilst the remainder of the Solomon Islands material is glabrous. Furthermore the stem, rachises, stipules and inflorescences are covered with bristle-like hairs, a feature somewhat paralleling the condition found in '*L. cumingii*' of the *L. guineensis* complex.

However, although certain general trends in leaf dimension and vestiture can be recognized, random exceptions occur in all areas and no absolute trends can be delimited. So within New Guinea occasional glabrous leaved species occur which cannot be separated from material from normal populations in Malaya. The problem is to obtain uniform comparable samples from the wide-spread populations of a species common in populated areas and frequently subjected to cutting and coppicing.

25. Leea smithii KOORD. Minah. (1898) 398, 622; Fl. N.O. Celebes, Suppl. 2 (1922) pl. 59; *ibid.* Suppl. 3 (1922) 29; KOORD.-SCHUM. Syst. Verz. 3 (1914) 79; SUESSENG. in E. & P. Nat. Pfl. Fam. ed. 2, 20d (1953) 386; RIDSDALE, Blumea 22 (1974) 96, f. 4/9. — *L. boerlageana* KOORD. Minah. (1898) 68, *nomen.* — **Fig. 3.**

Small tree up to 3 m. *Leaves* 1- or 2-pinnate. Petiole over 30 cm (*c.* 40 cm in plate); *stipules* 6 by 3 cm, scar 4 cm; rachis 60–?120 cm. Petiole, rachis and costa with crisped fluted emergences. Leaflets elliptic-oblong, (13–) 30–40 by (7–) 10–17 cm, glabrous, chartaceous; pearl glands subglobose, black; margins shallowly denticulate; apex acuminate; base rounded; nerves 10–18 pairs, slightly pubescent and with small emergences;

petiolules 5–15 mm. *Inflorescences c.* 5 cm overall. *Flowers* unknown. *Fruit c.* 10 mm ∅ ; seeds 6.

Distr. *Malesia*: NE. Celebes (Minahassa). Fig. 16.

Ecol. Understorey treelet of primary forest, 650 m.

Note. In absence of flowers the taxonomic status and position remains in doubt. The fluted stems and the structure of the epidermis and cuticle are very distinctive. However, there is a possibility that the taxon represents an extreme variation of *L. indica* (BURM. *f.*) MERR.

Dubious species

Leea erecta VOLL. & BRADE, Rodroguesia 1 (1935) 59, *nom. nud.*

An invalid horticultural name entered in a seed list.

Leea humilis HASSK. Cat. Hort. Bog. (1844) 169, *descr. in nota*; MIQ. Fl. Ind. Bat. 1, 2 (1859) 611 = probably *L. aequata.*

Leea javanica BL. *ex* SPRENG. Syst. Veg. 1 (1824) 670; BL. Bijdr. (1825) 197; SPRENG. Syst. Veg. 4, 2 (1827) Cur. post. 70; G. DON, Gen. Hist. 1 (1831) 712; STEUD. Nom. Bot. ed. 2, 2 (1840) 21; HASSK. Cat. Hort. Bog. (1844) 168; MIQ. Fl. Ind. Bat. 1, 2 (1859) 610.

BLUME's description reads: 'L: caule tereti punctato-scabro, foliis bipinnatis, foliolis infimis saepe geminis, oblongis acute serrulatis glabris'.

No authentic specimen of this species has been traced, a situation which was also reported by KOORDERS & VALETON (Bijdr. 9, 1903, 13). From the description it can be seen that the taxon has bipinnate leaves with glabrous leaflets. Thus, if it is a *Leea*, by elimination of other possibilities, the description must apply to either *L. guineensis* G. DON or *L. indica* (BURM. *f.*) MERR.

It has variously been interpreted as one or the other by most authors except KOORDERS who, in earlier years, in part identified plants of *L. aculeata* BL. *ex* SPRENG. with this taxon. This clearly is an error as the leaves in this species are always 1-pinnate.

KING, RIDLEY, and BACKER & BAKH. *f.*, interpreted it to have green flowers and thus representing a form of *L. indica.*

On the other hand, MIQUEL, and MERRILL, considered that it represented a red flowering taxon.

This latter view would seem more probable, as BLUME also described two forms of *L. indica* under *L. sambucina* WILLD. and *L. robusta* BL. the remaining possible entity of this species likely to be distinguished would be *L. sundaica* MIQ., but this has pubescent leaves.

If it can be shown conclusively that it represents a red flowered species then clearly this name will take priority over *L. guineensis.*

Excluded species

Leea cordata WALL. Cat. (1832) *n.* 6819; STEUD. Nom. Bot. ed. 2, 2 (1840) 21; KURZ, J. As. Soc. Beng. 42, ii (1837) 66, *in nota*, all *nom. nud* = *Vitis sp.* (*Vitaceae*), *cf.* LAWSON, Fl. Br. Ind. 1 (1875) 668.

Leea laevis HEYNE *ex* WALL. Cat. (1829) *n.* 1258, *nom. nud.*; HOOK. & JACKSON, Ind. Kew. 2 (1895) 48, *pro syn.* of *Heynea trijuga* ROXB. = *Trichilia connaroides* (W. & A.) BENTV. (*Meliaceae*), *cf.* BENTV. Act. Bot. Neerl. 11 (1962) 13.

Leea odontophylla WALL. Cat. (1832) *n.* 6820, *nom. nud.* = *Ampelopsis latifolius* (WALL.) PLANCH. (*Vitaceae*), *cf.* LAWSON, Fl. Br. Ind. 1 (1875) 668.

Leea spinosa SPRENG. Syst. Veg. 1 (1825) 670 = *Aralia chinensis* L. (*Araliaceae*). MERRILL (Int. Rumph. 1917, 347) has pointed out that SPRENGEL apparently intended only to transfer to *Leea* the plant depicted by RUMPHIUS (Herb. Amb. 4, 1743, t. 44). LINNAEUS (Syst. Nat. ed. 10, 1759, 967) included this plate in the synonymy of *Aralia chinensis* following the interpretation of STICKMAN (Herb. Amb. 1754, 16; LINNÉ, Amoen. Acad. 4, 1759, 127). Unfortunately SPRENGEL's good intentions went astray as he effectively renamed *Aralia chinensis* L. (Sp. Pl. 1753, 273) and did not name the plant from Ambon.

BALANOPHORACEAE (B. Hansen, Copenhagen)

Herbaceous, fleshy root parasites, destitute of chlorophyll and roots, with yellowish white to yellow, brown, orange to red or rose pink colours. At point of contact with host root a cylindrical or subspherical, branched or unbranched solid tuber develops. Stem appearing from the tuber endogenously or exogenously, leafless or with scaly leaves. *Inflorescence* spadix-like with unisexual flowers, ♂, ♀, or ♀♂, in the Mal. *spp.* unbranched. ♂ *Flowers* pedicellate or sessile, supported by bracts or not, 2–6-merous. Tepals 2–6 in one series, free from each other. Stamens 2–4(–?), opposite the tepals, united into a synandrium. ♀ *Flowers* apparently not supported by bracts, with or without a minutely 2-lobed perianth adnate to the ovary. Styles 2 or 1. *Ovary* with 1 embryo, apparently without a cavity. Embryo very small, embedded in a more or less well developed endosperm.

Distribution. About 45 species in 18 genera in the tropics and subtropics of the world. As to our present knowledge 7 genera are exclusively South American, 4 genera are exclusively African, 2 are Asian, 1 is from Madagascar, 1 from New Zealand, and 1 from New Caledonia. Two genera have remarkable distributions, *viz Langsdorffia* with 3 species, 1 in South America, 1 in Madagascar and 1 in New Guinea, and *Balanophora* with 15 species from tropical Africa to Tahiti and Marquesas, one of the species covering almost the entire area (see *B. abbreviata*).

Ecology. Mostly in mountain forests parasitizing trees, rarely herbs. No particular host-affinity could be demonstrated within *Balanophora*, which is known to parasitize at least 74 host species belonging to 35 families. *B. fungosa* parasitizes at least 25 species.

Dispersal. Factual information is very scarce. Ridley (Disp. 1930, 39) observed in Christmas I. and P. Aur in Johore that 'in preserving specimens' (of the monoecious *B. abbreviata*) '. . . the minute fruits drifted away on the high breezes, like the pollen of a conifer. They were produced in great abundance on the little plant and borne on short stalks. The plants, which were very scanty, grew in open woods or between high rocks.' He also observed that this species is widely distributed in Oceanic islands, occurring from Madagascar and the Comores as far east as the Marquesas Is.

Diaspores are indeed very light: the average weight of those of *B. fungosa ssp. indica* are 0.007 mg, that is only four times heavier than the lightest orchid seed.

However, Ridley correctly pointed out that 'the other species grow in dense forest in wet spots, their fruits are not so small and are apparently diffused mainly by rain-wash. These are quite absent from other islands.' This is not quite true; they do occur in islands, not only in those of the Malesian archipelago, but *B. fungosa ssp. fungosa* occurs also in the Solomons, New Caledonia, New Hebrides, and Fiji, while *B. wilderi* is confined to Rarotonga and Rapa Is.

For these others, and the species of the genera *Rhopalocnemis*, *Exorhopala*, and *Langsdorffia*, which all grow in the depth of dense everwet rain-forest, dispersal by wind is excluded while dispersal by rain-wash can only be very local and is insufficient to explain the large to almost world-wide ranges of the *Rhophalocnemis* affinity and *Langsdorffia* respectively. They grow on the forest floor and often do emerge only very little from the litter. Their spadices decay gradually and rot away, as was observed in *Rhopalocnemis* (fig. 2).

It has been advanced by Koningsberger (Java, Zool. en Biol. 1915, 425, 614) that in the Javanese mountain forest pigs feed on tubers of *Balanophora*, but this appears obviously to be a loose assumption or a misinterpretation of their digging activity, as Docters van Leeuwen with his immense experience and acute observation denied it (Verh. Kon. Ak. Wet. A'dam, sect. II, 31, 1933, 71).

Van Steenis (Mt. Fl. Java, 1972, pl. 5–1) has advanced that dispersal of these forest floor parasites takes place, similarly as in *Rafflesiaceae*, epizoically by game, mainly by ungulates, but possibly also by other animals, large and small.

The dioecism which prevails in several species, makes dispersal over long distances still more problematic, similarly as in *Rafflesiaceae* in which species and genera show large, or even immense disjunctions. It is clear that these disjunct ranges are testimony of the great age of these parasite families and that the range histories reflect extinction and a chequered history going back to a dim past.

About the life-span of viable seed nothing is known unfortunately. Also about the way of infecting the host plant and its first life-stages no factual data are available. In *Rafflesia* it has been shown experimentally that infection can only take place on wounded roots or stems. This may be true for these *Balanophoraceae*. The solving of the secret of Balanophoraceous infection is one of the many goals of future tropical research.

Pollination. Again very few observations have been reported. Various insects have been observed visiting male flowers of *Balanophora fungosa ssp. indica* (Hansen). In *Balanophora papuana* the male flowers open in being touched (Forman). Inflorescences of *Balanophora reflexa* smell from fox in the morning (Corner) and could possibly thus attract *Diptera* or *Hymenoptera*.

VAN STEENIS (Hand. 6th Ned. Ind. Natuurwet. Congr. 1931, 1932, 470) observed that the supporting hairs of the female flowers in *Rhopalocnemis* excreted nectar, but no insect visitors were observed by him or VAN DER PIJL. GOVINDAPA & SHIVAMURTHY (Ann. Bot. 39, 1975, 977) found bees collecting pollen of *Balanophora abbreviata* and its ♀ flowers producing a sugary liquid.

Pollen morphology. The pollen of the *Balanophora* species has recently been described by me in detail (Dansk Bot. Ark. 28, 1972, 31–36). This genus proved to be eurypalynous with the grains spherical or slightly ellipsoid, equatorial diam. 13–31 μ, polar axis 12–31 μ, non aperturate, triporate or polypantoporate with up to 12 apertures, exine granular from numerous conical, obtuse or apiculate bodies 0.4–0.8 μ high. In *Langsdorffia* the pollen is (3–) 4 (–5)-porate, exine more or less granular. Tricolpate grains have been found in *Rhopalocnemis* and *Exorhopala*.

Anatomy & morphology. In several species seed setting is by apogamy or parthenogenesis, as has been studied in Java or based on Javanese material by TREUB in *Balanophora elongata* (Ann. Jard. Bot. Btzg 15, 1898, 1–23, pl. 1–8), LOTSY in *B. fungosa ssp. indica var. globosa* (*ibid.* 16, 1899, 174–185, t. 16–19) and ERNST (Festschr. Eröffn. neuen Inst. f. Allg. Bot. Zürich, 1914, 145–176, 2 tab.). The same has been found in *Rhopalocnemis* by LOTSY (Ann. Jard. Bot. Btzg 17, 1901, 73–101, t. 3–14) and ERNST (Flora 106, 1913, 129–159, 2 Taf.).

FAGERLIND (Svensk Bot. Tidskr. 32, 1938, 139–159; *ibid.* 39, 1945, 65–82) made it clear, however, that these authors were mostly wrong in their interpretation and concluded that normal sexual reproduction occurs in most *Balanophoraceae*. Within the genus *Balanophora* agamospermy was found only in *B. fungosa ssp. indica var. globosa* and in *B. japonica*.

FAGERLIND's papers have shed doubt on the use of the terms 'ovary cell', 'ovule' and 'pendulous' nature of the latter, as there seems to be no cavity in the ovary. I have consequently abandoned these terms and restricted myself to speak of an embryo consisting of a few cells which is embedded in the tissue of the ovary.

VON GUTTENBERG (Planta 34, 1945, 193–220) studied the anatomy of *Balanophora* material he collected in Sumatra and came to the conclusion that the tubers of *Balanophora* should be interpreted as root tubers. It should be realized, however, that the tuber contains also fused root tissue of the host. Compare fig. 5.

A detailed, comprehensive review of the knowledge concerning the anatomy of *Balanophora* is given by FAGERLIND (Kungl. Svenska Vet. Akad. Handl. 25, 3, 1948, 1–72), where also important original observations are reported. HARMS (in E. & P. Nat. Pfl. Fam. ed. 2, 16b, 1935, 296–339) has summarized the knowledge concerning *Balanophora* as well as of other genera. Further METCALFE & CHALK (Anat. Dic. 2, 1950, 1205) should be consulted and my thesis on *Balanophora* (Dansk Bot. Ark. 28, 1972, 19–30). FAGERLIND has in a series of papers: Svensk Bot. Tidskr. 32 (1938) 139–159 and *ibid.* 39 (1945) 197–210; Ark. Bot. Stockh. 29A, 7 (1938) 1–15; Bot. Not. 4 (1945) 330–350, reviewed and given much new evidence concerning floral morphology and anatomy of several genera. The latest review by KUIJT (The biology of parasitic flowering plants, 1969, 118–135) deals with most aspects of the biology of *Balanophoraceae*.

Chromosomes. Because of their small size countings are very difficult in *Balanophora*. I have surveyed data and added some myself (Dansk Bot. Ark. 28, 1972, 37–38) in which n numbers are found to be *c.* 16 or *c.* 18, and 2n *c.* 36 for *Balanophora abbreviata*, 56 and 94–112 for *B. japonica*. DARLINGTON & WYLIE (1955) listed for *Cynomorium* n = 12 and for *Helosis* and *Thonningia* both n = 18.

Phytochemistry. Candles are prepared from species of *Balanophora* and *Langsdorffia*; their tissues contain large amounts of a wax-like substance called balanophorin. Balanophorin from *Balanophora fungosa ssp. indica var. globosa* (JUNGH.) HANSEN (err. *B.* '*bulbosa*' JUNGH.) and *B. elongata* BL. consists mainly of β-amyrin palmitate which is accompanied by small amounts of rubber. *B. japonica* MAKINO is used to prepare a bird-lime; it contains esters of β-amyrin and taraxasterol and probably appreciable amounts of rubber too. Several observations as well as some medicinal uses indicate that *Balanophoraceae* are rich in phenolic and tannin-like substances. Recent investigations with two species shed some light on the nature of these constituents. Large amounts of coniferin were isolated from a *Balanophora* species used in Thai medicine as an antiasthmatic; at the same time 0.3 % of β-amyrin acetate was obtained (V. PODIMUANG *et al.* Chem. Pharm. Bull. Tokyo 19, 1971, 207). From rhizomes of *Lophophytum leandri* EICHL. WEINGES *et al.* isolated polymeric proanthocyanins (= condensed tannins), eriodictyol (a flavanon), taxifolin (a flavanonol), (–)-epicatechin and glycosides of eriodictyol, naringenin, quercetin and epicatechin (Phytochemistry 10, 1971, 829). These recent observations confirm the presence of condensed tannins and their building stones (catechins) in the family. However, trihydroxylated constituents (myricetin, gallic acid, gallo-catechins) were not yet detected in *Balanophoraceae*. Chemical knowledge of the taxon is still too scanty for a balanced chemosystematic evaluation. The patterns of phenolic and triterpenic constituents seem to agree rather well with the often accepted santalalean relationships (see TAKHTAJAN, Flowering plants, origin and dispersal, 1969). It should be remembered, however, that most species have not yet been investigated hitherto and that fatty acids with acetylene linkages seem to be lacking in the family (H. H. HATT *et al.* Austr. J. Chem. 20, 1967, 2285: *Balanophora fungosa* FORST.). For additional references see: HEGNAUER, Chemotaxonomie der Pflanzen 3 (1964). — R. HEGNAUER.

Taxonomy. In his masterly monograph (Trans. Linn. Soc. Lond. 22, 1856, 1–68) HOOKER *f.* treated 12 genera, as delimited today, and 28 species. VAN TIEGHEM, Ann. Sc. Nat. Bot. IX, 6 (1907) 125–260

treated as two families, *viz Balanophoraceae* and *Langsdorffiaceae*, what is now known as *subfam. Balanophoroideae*; he enumerated 51 species. In my recent revision of *Balanophora* (Dansk Bot. Ark. 28, 1972, 1–188) I reduced the number of species to 15. In *Langsdorffia* there seem to be 3 and in *Thonningia* only 1 species, which makes a total of 19 species today within *subfam. Balanophoroideae*.

Uses. *Balanophora elongata* contains large amounts of wax in the tubers and has been used on Java for making torches. Outside the Malesian area there are reports from Thailand and Japan on making bird-lime from the wax of *Balanophora* tubers.

Note. Good material of *Rhopalocnemis* and *Exorhopala* is extremely scarce and it has been necessary to some extent to rely upon observations published by botanists, who studied fresh material (JUNGHUHN, VAN STEENIS, RIDLEY). Regarding *Langsdorffia papuana* nothing can be added to the careful observations made by GEESINK.

KEY TO THE GENERA

1. Stem of inflorescence leafless. Young inflorescences with a closed cover of spirally arranged, polygonate, peltate scales, which are caducous in anthesis. Styles 2.
2. Stem of inflorescence more or less scaly, originating endogenously from a more or less spherical tuber forming a sheath round the base of the stem; perianth of male flowers tubular, lobes 4 or inconspicuous . . . . . **1. Rhopalocnemis**
2. Stem of inflorescence without scales, apparently originating exogenously from an elongated tuber, no sheath observed; perianth of male flowers conspicuously 4-lobed. . . . . **2. Exorhopala**
1. Stem of inflorescence with leaves, the upper ones covering the young inflorescence; the latter without such scales. Style 1.
3. Leaves (in Mal.) up to 30, wide, rounded, or blunt. Flowers arranged on a globular to elongate axis. Tubers with surface fine granular to coarsely warted, scattered stellate warts mostly present. Female flowers free from each other, intermixed with club-shaped spadicles. Tuber with wax. **3. Balanophora**
3. Leaves very many (80–100), linear, very acute. Flowers arranged on the flattish, thickened apex of the stem. Tubers with surface densely pubescent, never granular or warted. Female flowers apparently adnate to each other, spadicles absent. Tuber starchy . . . . . **4. Langsdorffia**

1. RHOPALOCNEMIS

JUNGH. Nov. Act. Ac. Caes. Leop.-Car. 18, Suppl. 1 (1841) 213; GOEPP. *ibid.* 22, 1 (1847) 148, t. 11–15; HOOK. *f.* Trans. Linn. Soc. 22 (1856) 31, 52, t. 12; EICHL. in DC. Prod. 17 (1873) 138; HOOK. *f.* in B. & H. Gen. Pl. 3 (1880) 238; ENGL. in E. & P. Nat. Pfl. Fam. 3, 1 (1889) 259; LOTSY, Ann. Jard. Bot. Btzg 17 (1901) 75; STEEN. Hand. 6th Ned. Ind. Natuurwet. Congr. 1931 (1932) 470; HARMS in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 323, f. 163. — *Phaeocordylis* GRIFF. Trans. Linn. Soc. 20 (1846) 100. — *Lytogomphus* JUNGH. *ex* GOEPP. Nov. Act. Ac. Caes. Leop.-Car. 22, 1 (1847) 122, *nom. nud.* — **Fig. 1–5.**

Dioecious or monoecious plant. A large basal tuber develops at the point of contact with the host root; surface of tuber irregularly corrugated; tuber starchy. *Inflorescence-bearing stem* breaking through the outer tissues of the tuber, which in turn forms a conspicuous, by tearing irregularly lobed sheath around the base of the stem. Stem leafless or with spirally arranged, slightly recurved warty scales. *Inflorescences* spadix-like, unisexual or bisexual, at first covered by the flattened, marginally cohering tops of polygonate, peltate scales (fig. 3); central area of scale often developing a wart or a slightly recurved structure much resembling the scales on lower part of stem; scales caducous in flakes at anthesis. ♂ *Flowers* with a tubular perianth splitting irregularly or apparently in 4 lobes. Stamens forming a columnar synandrium with the anthers united into a head containing 20–30 thecae in 2–3 layers. ♀ *Flowers* with perianth adnate to the ovary and forming 2 low crests at the top of the ovary, one anterior and one posterior, alternating with the caducous styles. Stigma conspicuous, capitate. *Ovary* slightly compressed in anterior-posterior direction.

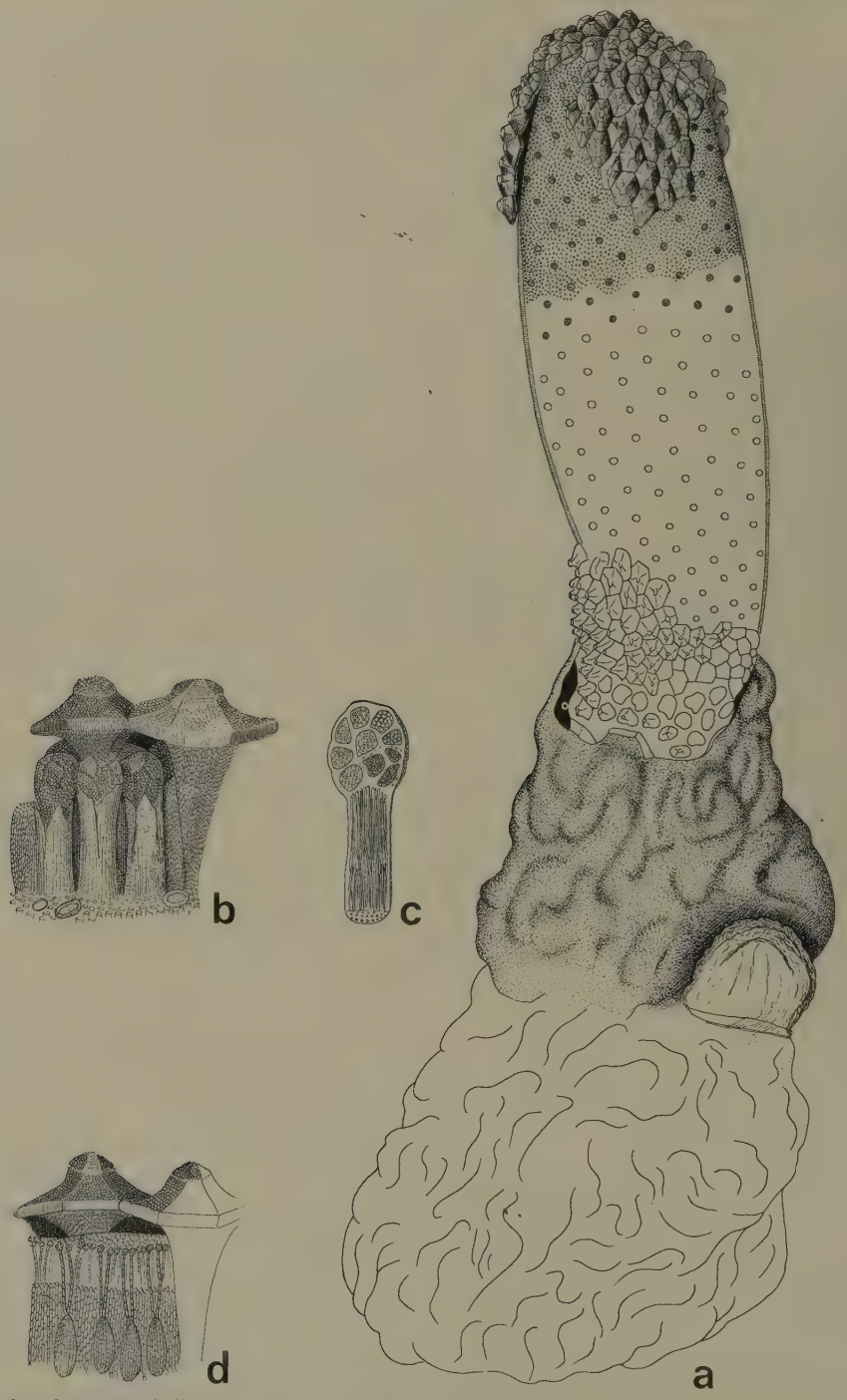

Fig. 1. *Rhopalocnemis phalloides* JUNGH. *a*. Habit, peltate scales shed in major part of ♀ inflorescence, each leaving a circular scar, × ²/₃, *b*. section of inflorescence showing ♂ flowers covered by peltate scales, × 5, *c*. LS of stamen, × 9, *d*. section of inflorescence showing ♀ flowers surrounded by supporting hairs and still covered by peltate scales, × 5 (after GOEPPERT, 1847).

Distr. Monotypic. E. Himalaya, Indo-China, in *Malesia*: Sumatra, Java, Celebes, and Central Moluccas (Buru). Fig. 6.

Note. The closest taxonomic relatives within *subfam. Helosidoideae* are *Exorhopala* in Malaya and *Ditepalanthus* in Madagascar (*cf.* HANSEN, Bot. Tidsskr. 69, 1974, 58–59).

Fig. 2. *Rhopalocnemis phalloides* JUNGH. in mossy forest on Mt Kemiri, Losir Mts, N. Sumatra, *c.* 2500 m altitude. Left a spadix in course of throwing off the scales, 2 ♀ spadices in full anthesis, right 3 old ones in decay, all from an enormous tuber (Photogr. VAN STEENIS, 1937).

1. Rhopalocnemis phalloides JUNGH. Nov. Act. Ac. Caes. Leop.-Car. 18, Suppl. 1 (1841) 215; GOEPP. *ibid.* 22, 1 (1847) 149, t. 11–15; HOOK. *f.* Trans. Linn. Soc. 22 (1856) 31, 52, t. 12; MIQ. Fl. Ind. Bat. 2 (1859) 1066; EICHL. in DC. Prod. 17 (1873) 138; HOOK. *f.* Fl. Br. Ind. 5 (1886) 239; ENGL. in E. & P. Nat. Pfl. Fam. 3, 1 (1889) 260, f. 165A–E; LOTSY, Ann. Jard. Bot. Btzg 17 (1901) 76–101, t. 3–14; KOORD. Exk. Fl. Java 2 (1912) 173; JACOBSON, Trop. Natuur 6 (1917) 138, f. 10; STEEN. Bull. Jard. Bot. Btzg III, 13 (1934) 176; Trop. Natuur 23 (1934) 49, f. 7; HARMS in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 323, f. 163; KANJILAL *et al.* Fl. Assam 4 (1940) 133; BACK. & BAKH. *f.* Fl. Java 2 (1965) 79; CORNER & WATAN. Ill. Trop. Pl. (1969) 78; STEEN. Mt. Fl. Java (1972) pl. 5–3; HANSEN, Bot. Tidsskr. 67 (1972) 146, f. 1 (map). — *Phaeocordylis areolata* GRIFF. Trans. Linn. Soc. 20 (1846) 101, t. 8, f. 1–14. — *Lytogomphus stilbiferus* JUNGH. *ex* GOEPP. Nov. Act. Ac. Caes. Leop.-Car. 22, 1 (1847) 121, *nom. nud.* — **Fig. 1-5.**

Monoecious or dioecious plants (inflorescences bisexual or unisexual respectively) with yellowish to brownish colours. Total length from contact with host root to top of inflorescence 15–25 cm. *Tubers* 6–21 cm ⌀ and 6–13 cm long with a strong-

Fig. 3. *Rhopalocnemis phalloides* JUNGH. Two rugose tubers producing three young spadices still fully covered with scales, one ♀ mature (white). Mt Tangkuban Prahu, W. Java (Photogr. KUYPERS, coll. ARENS).

ly irregularly corrugated surface. Sheath around stem 1–5 cm long, irregularly lobed. *Inflorescence-bearing stem* 2–10 cm long, 2–5 cm ∅, with or without spirally arranged, slightly recurved, warty scales. *Inflorescence* 7–20 cm long, 3–7½ cm ∅. Top part of scales ½ cm ∅, in central part often developing a recurved structure much resembling the scales on lower part of stem. *Flowers* sessile, surrounded by numerous supporting hairs, which produce nectar. ♀ Specimens always with ♂ flowers in lower part of inflorescence.

Distr. E. Himalaya, Indo-China, in *Malesia*: Sumatra, Java, Celebes, and Moluccas (Buru). Fig. 6.

Ecol. Mountain forests, 1000–2700 m. Parasitizing roots of various woody plants: *Ficus fistulosa* REINW. *ex* BL. (*Morac.*), *Quercus pruinosa* BL., *Quercus sp.* (*Fagac.*) *Macaranga tanarius* (L.) M.A. (*Euph.*), *Albizia lophantha* (WILLD.) BTH. (*Leg.*), rarely supraterraneous stems: unknown liana (JUNGHUHN), *Ficus sp.* (*Morac.*), *Schima wallichii* (DC.) KORTH. *ssp. noronhae* (REINW. *ex* BL.) BLOEMB. (*Theac.*).

Note. Readily distinguished from *Exorhopala* by its yellowish to brownish colours, large, thick tubers, and endogenously originating stems.

Fig. 4. *Rhopalocnemis phalloides* JUNGH. from above. ♂ Spadices showing cream stamens, partly dropped; scales at apex are not yet shed all; 3 mature ♀ spadices. Telaga Warna near Puntjak, Mt Gedeh, W. Java, 1400 m (Photogr. VAN STEENIS)

Fig. 5. *Rhopalocnemis phalloides* JUNGH. Cross-section through a tuber and attached root showing fusion of tissues. Mt Papandajan, W. Java (Coll. VAN STEENIS).

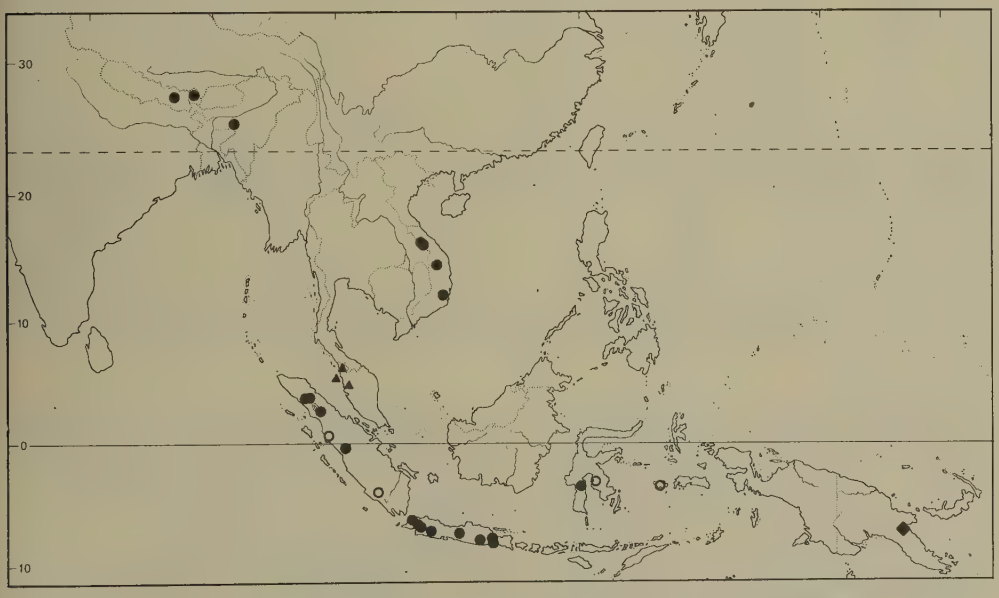

Fig. 6. Range of *Rhopalocnemis phalloides* JUNGH. (• specimens studied, ○ from literature), *Exorhopala ruficeps* (RIDL.) STEEN. (▲), and *Langsdorffia papuana* GEESINK (■).

2. EXORHOPALA

STEEN. Hand. 6th Ned. Ind. Natuurwet. Congr. 1931 (1932) 470; HARMS in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 324. — **Fig. 7.**

Point of contact with host plant (roots?) not known. *Inflorescence-bearing stem* leafless, appearing exogenously from elongated, horizontal tubers; no sheath observed. *Inflorescences* spadix-like, unisexual, at first covered by the conical top parts of marginally cohering peltate bracts. Bracts caducous on anthesis. Flowers mixed with numerous hairs. ♂ *Flowers* with a 4-lobed, short-tubular perianth. Stamens forming a columnar synandrium with the 4 anthers united into an elongated, ellipsoid head, which thus contains 8 linear cells (thecae). ♀ *Flowers* with compressed ovaries bearing 2 styles with very small capitate stigmas.

Distr. Monotypic. *Malesia*: Penang and Malay Peninsula. Fig. 6.
Note. Undoubtedly belonging in *Balanophoraceae-Helosidoideae*.

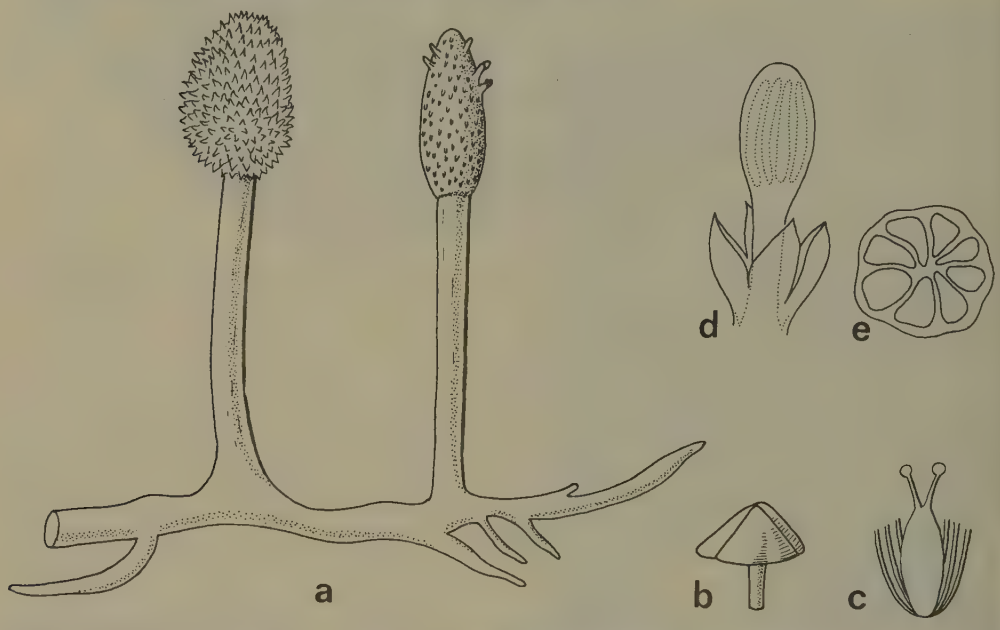

Fig. 7. *Exorhopala ruficeps* (RIDL.) STEEN. *a*. Habit, the inflorescence to the left still with peltate scales present, nat. size, *b*. peltate scale, × 5, *c*. ♀ flower with supporting hairs, × 7, *d*. ♂ flower, × 15, *e*. CS of synandrium, × 25 (*a–c* after RIDLEY, 1924, *d–e* after FAGERLIND, 1938).

1. Exorhopala ruficeps (RIDL.) STEEN. Hand. 6th Ned. Ind. Natuurwet. Congr. 1931 (1932) 470; HARMS in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 324; HANSEN, Bot. Tidsskr. 67 (1972) 147, f. 1 (map). — *Rhopalocnemis ruficeps* RIDL. Kew Bull. (1914) 188; Fl. Mal. Pen. 3 (1924) 176, f. 150. — **Fig. 7.**

Dioecious plant (inflorescences unisexual) with yellow to orange brown or rose colours. Basal organs not sufficiently known. *Inflorescence-bearing stem* appearing from an elongated, horizontal tuber at least 15 cm long and $^1/_2$ cm wide. Stem naked, 4–10 cm long, $^3/_4$ cm ∅, yellow. *Inflorescence* 3–5 (–10) cm long, 2–3 cm ∅ incl. of bracts, rose pink, covered by the conical top parts of marginally cohering, peltate bracts. Bracts bright red, with top part $^1/_2$ cm long and 0.4 cm wide at base, caducous on anthesis. ♂ *Flowers* 2 mm long. ♀ *Flowers*: stigmas very small, head-like.

Distr. *Malesia*: Penang (Penara Bukit) and Malay Peninsula (Perak: Thaiping Hills), very rarely collected. Fig. 6.

Ecol. Dense forest, 100–1200 m. Contact with host plant not known.

Note. Distinguished from *Rhopalocnemis* by its yellowish-reddish colours, horizontally spreading tubers, and exogenous origin of the spadices.

3. BALANOPHORA

J. R. & G. FORST. Char. Gen. Pl. (1776) 99; BL. En. Pl. Jav. (1827) 86; JUNGH. Nov. Act. Ac. Caes. Leop.-Car. 18, Suppl. 1 (1841) 201–228, t. 1–2; GOEPP. *ibid.* 18, 1 (1842) 231–272, t. 1–3; MIQ. Fl. Ind. Bat. 2 (1859) 1064; EICHL. in DC. Prod. 17 (1873) 143; HOOK. *f.* in B. & H. Gen. Pl. 3 (1880) 235; BOERL. Handl. 3, 1 (1900) 183; TIEGH. Ann. Sc. Nat. Bot. IX, 6 (1907) 144; HARMS in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 329, f. 166–168; HANSEN, Dansk Bot. Ark. 28 (1972) 84, a complete monograph, 188 pp. — *Cynopsole* ENDL. Gen. Pl. (1836) 74. — *Acroblastum* SOLAND. [*Primitiae florae insularum oceani pacific 310, 311 in sched.*] *ex* SEEM. Fl. Vit. (1866) 100. — *Balaniella* TIEGH. Ann. Sc. Nat. Bot. IX, 6 (1907) 144. — **Fig. 8–24.**

Stems emitted from basal tubers. Total length of parasite incl. of tuber 2–30 cm. *Tubers* mostly in a mass 1–25 cm ⌀, branching from the base, containing wax (balanophorine) in varying amounts. Single tubers 1–6 cm long and 1–6 cm wide, ovoid, ellipsoid, or obovoid, sometimes almost cylindrical or spherical. In a few species the tubers are repeatedly branched with elongated, cylindrical branches, thus forming an entangled mass 10–30 cm ⌀. Surface of tubers fine-granular to coarsely tessellate, with or without stellate warts. *Stem* appearing from a greater or smaller pit at the apical part of each single tuber. *Leaves* 2–40, broad-based, whorled, opposite, distichous or spirally arranged. *Inflorescence* spadix-like, terminating the stem. *Flowers* unisexual, pedicellate or not. ♂ *Inflorescences* racemose or spicate, 1–18 cm long and $^1/_2$–7 cm wide in anthesis. ♀ *Inflorescences* spicate, ovoid, ellipsoid, obovoid, or spherical, $^1/_2$–7 by $^1/_2$–$8^1/_2$ cm, number of flowers estimated in one inflorescence 10^5–10^7 according to size. ♂ *Flowers* mostly subtended by short, truncate bracts. In ♀ inflorescences the bracts are transformed to more or less club-shaped spadicles $^1/_2$–$2^1/_2$ mm long, surrounded by ♀ flowers; in some species ♀ flowers are also situated on the lower, narrow part of each spadicle. Species monoecious as well as dioecious. Monoecious species have bisexual inflorescences with the ♂ flowers intermixed with the ♀ flowers or in a zone below and/or above the ♀ part. ♂ *Flowers* with a perianth of 3, 4–5 or 6, in exceptional cases up to 14, tepals, actinomorphic or bisymmetric to zygomorphic on account of lateral elongation. Tepals ovate to lanceolate, acute or almost square and truncate. Stamens forming a more or less elongated synandrium. Anthers 4–5 or numbers indeterminable, cells longitudinally dehiscing, sometimes transversally divided into smaller locelli. Anthers opposite to tepals when few in number. ♀ *Flowers* without a perianth. Ovary 0.2–0.7 mm long and 0.15–0.4 mm wide. Style $^1/_2$–$1^1/_2$ mm long, apparently stigmatoid at and near apex, where pollen grains are often found attached. *Fruit* indehiscent, nut-like. Embryo few-celled, embedded in a small endosperm. Diaspore: fruit with or without parts of pedicel and style attached.

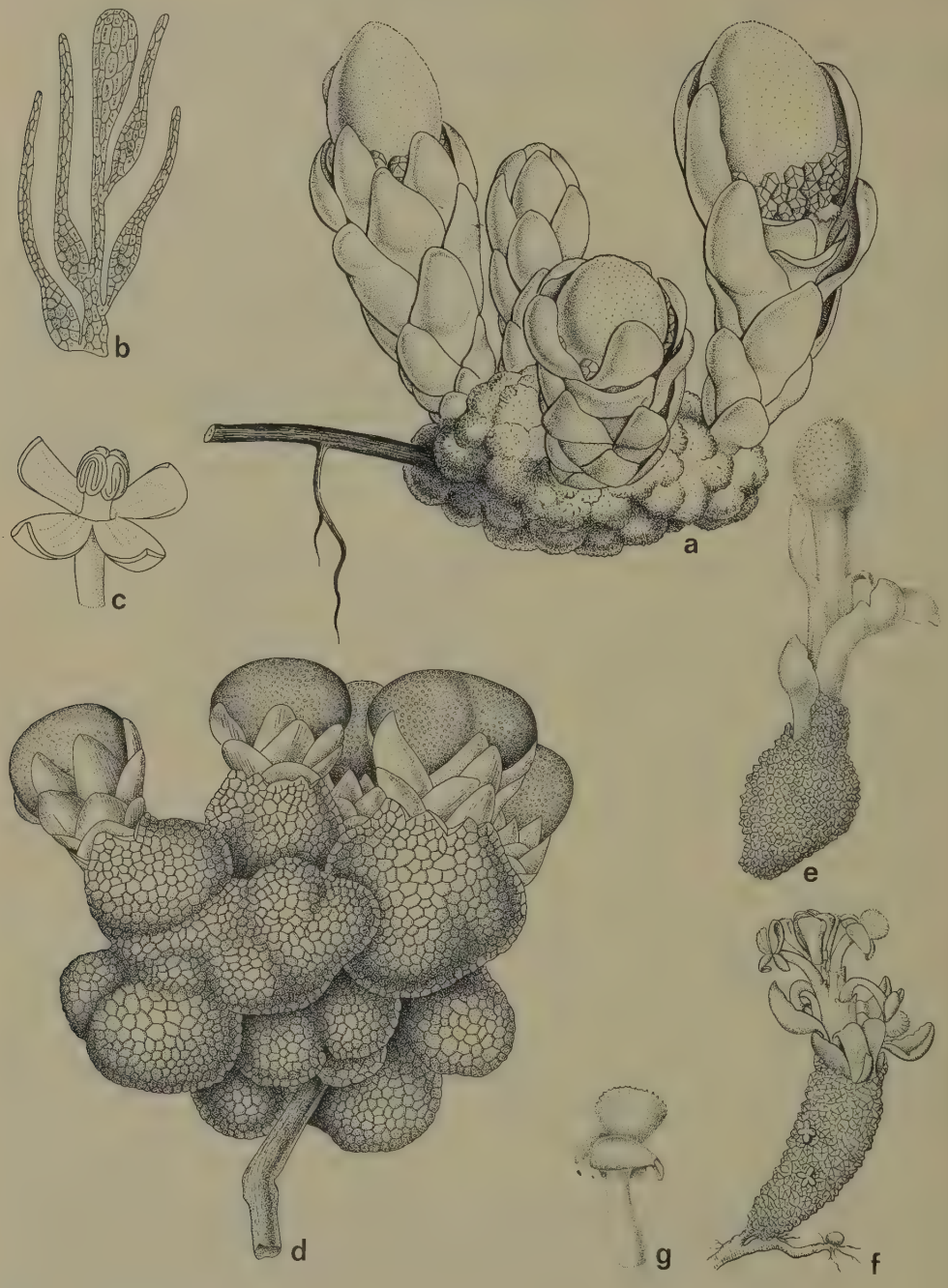

Fig. 8. *Balanophora fungosa* J. R. & G. FORST. *ssp. fungosa*. *a*. Habit, × ²/₃, *b*. spadicle with 4 ♀ flowers, × 33, *c*. ♂ flowers, × 3. — *B. fungosa ssp. indica* (ARN.) HANSEN *var. globosa* (JUNGH.) HANSEN. *d*. Habit, × ²/₃. — *B. reflexa* BECC. *e*. ♀ Specimen, habit, × ²/₃, *f*. ♂ specimen, habit, × ²/₃, *g*. ♂ flower, × 1¹/₃ (*a–c* after HOOKER *f*., 1856, *d* after JUNGHUHN, 1841, *e–g* after BECCARI, 1869).

Distr. About 15 species in temperate to tropical Asia, throughout *Malesia*, Pacific islands, tropical Australia, Comores, Madagascar, and tropical Africa (Congo).

Ecol. Parasitizing roots, rarely supraterraneous stems, of woody, rarely herbaceous, dicotyledonous species, in exceptional cases *Bambusa* and even *Pinus*.

Vern. *Prut*, S, a generic name, followed by the name of the host, *e.g. prut tjantigi*, *Balanophora* on *Vaccinium*, *etc.*

Notes. In no case have unisexual inflorescences of both sexes been observed to appear from one tuber. However, careful examination is necessary, when two seeds have germinated close to each other on the same root-tip, one producing a male plant, the other a female plant: such a case was observed in *B. fungosa ssp. indica*.

Dwarf specimens parasitizing extremely tiny roots were observed in *B. fungosa ssp. indica*. They probably occur in other species too, but are easily overlooked.

KEY TO THE SPECIES, SUBSPECIES, AND VARIETIES

1. Female and male flowers in the same inflorescence.
 2. Leaves distichous. Male flowers sessile, bisymmetric or zygomorphic . . . . . **6. B. abbreviata**
 2. Leaves spirally arranged, rarely subopposite. Male flowers pedicellate, actinomorphic. **1. B. fungosa**
1. Female and male flowers in different inflorescences.
 3. Male specimens only. (Note: flowers at proximal and distal parts of inflorescence often not typically developed.)
  4. Male flowers actinomorphic, 4- or 5-merous, rarely 3- or 6-merous. Tepals all lanceolate, acute. **1. B. fungosa *ssp.* indica**
  4. Male flowers bisymmetric or zygomorphic, 4-merous, rarely 5- or 7–14-merous. Lateral tepals narrow, acute, median tepals wide, truncate.
   5. Pedicels 14–18 mm, during anthesis much reflexed. Lateral tepals extremely narrow and acute, median tepals very wide, square, truncate. Synandrium completely compressed in anterior-posterior direction (Borneo, Malaya). . . . . **5. B. reflexa**
   5. Pedicels absent or at most up to 6 mm.
    6. Leaves always distichous . . . . . **7. B. latisepala**
    6. Leaves spirally arranged or opposite, decussate.
     7. Leaves spirally arranged, gradually increasing in size upwards on the stem, the upper ones elliptic, concealing inflorescence during anthesis. Tuber elongated and regularly branched. **2. B. elongata**
     7. Leaves opposite, decussate.
      8. Leaves 6–8 pairs, gradually increasing in size upwards on the stem, the uppermost ones almost orbicular in outline, cucullate, completely concealing the inflorescence during anthesis. Tuber spherical, not branched (Borneo) . . . . . **4. B. lowii**
      8. Leaves 2–4 (–5) pairs, all of nearly the same size; in case of 4 leaves only, the two pairs often very close to each other, apparently whorled, patent during anthesis. Tubers branched (3–12 branches) with slightly elongated parts . . . . . **3. B. papuana**
 3. Female specimens only. (Note: in some cases difficult to key out properly.)
  9. Leaves whorled or opposite and decussate.
   10. Leaves 4, distinct, apparently whorled at the upper part of the stem . . . . . **3. B. papuana**
   10. Leaves opposite and decussate.
    11. Leaves gradually increasing in size upwards on the stem; the uppermost leaves almost orbicular, cucullate, concealing the flowering inflorescence . . . . . **4. B. lowii**
    11. Leaves almost equal in size except for the lowermost 1–3 pairs . . . . . **3. B. papuana**
  9. Leaves distichous or spirally arranged.
   12. Leaves distichous . . . . . **7. B. latisepala**
   12. Leaves spirally arranged.
    13. Spadicles without flowers in lower part. (Note: easily observed with handlens on cross-section of inflorescence.) (Borneo and Malaya only) . . . . . **5. B. reflexa**
    13. Spadicles with flowers in lower part.
     14. Upper leaves not covering the flowering inflorescence. . **1. B. fungosa *ssp.* indica *var.* indica**
     14. Upper leaves totally or partially covering the flowering inflorescence.
      15. Stem elongated, slender. Female inflorescence ellipsoid. Tubers elongated and repeatedly branched . . . . . **2. B. elongata *var.* elongata**
      15. Stem very short and stout. Tubers not elongated.
       16. Female inflorescence subspherical-ellipsoid. Leaves coarsely longitudinally striate (Java only). . . . . **2. B. elongata *var.* ungeriana**
       16. Female inflorescence subspherical, markedly depressed. Leaves smooth (Java only). **1. B. fungosa *ssp.* indica *var.* globosa**

1. Balanophora fungosa J. R. & G. FORST. Char. Gen. Pl. (1776) 99, t. 50; MERR. En. Philip. 2 (1923) 118; HANSEN, Dansk Bot. Ark. 28 (1972) 93, f. 19. — *B. micholitzii* RIDL. J. Str. Br. R. As. Soc. 39 (1903) 207; *ibid.* 45 (1906) 219. — **Fig. 8–11.**

ssp. **fungosa.** — **Fig. 8a–c.**

Monoecious plant (inflorescences bisexual), pale yellow, yellow to orange yellow or yellowish brown, sometimes with pinkish tinges. Length from fusion with host root to top of inflorescence 6–12 cm. *Tubers* single or in a mass 10–15 cm wide, branching from the base. Single tuber subspherical or depressed, *c.* $1^1/_2$ by $2^1/_2$ cm. Surface granular with stellate warts. Stem $2^1/_2$–11 cm. *Leaves* 15–30, spirally arranged, rarely subopposite, imbricate, 2–3 by $1^1/_2$–2 cm, obtuse, slightly cucullate. ♂ *Flowers* 2–20, in a zone $^1/_2$–1 cm high just below ♀ part of inflorescence, 4–5-merous, actinomorphic, subtended by short (1–2 mm), truncate, rudimentary bracts. Pedicels 3–7 mm. Tepals ovate-elliptic, acute. Synandrium ovoid-ellipsoid, slightly compressed in anterior-posterior direction. Anthers 4–5, horseshoe-shaped. ♀ *Part of inflorescence* (1–) $1^3/_4$–$2^1/_4$ (–$3^1/_2$) cm long and ($1^1/_4$–) $1^1/_2$–$2^1/_4$ (–$3^1/_2$) cm wide, subspherical to short ovoid. Spadicles (1110–) 1130 (–1150) μ long, long-obconical or with a lower, cylindrical part about 100 μ wide and an upper, obconical part 170–240 μ wide. ♀ *Flowers* on main axis of inflorescence and a few also in lower part of the spadicles. Largest ♀ flowers with pistils c. 1250 μ long, ovary about 400 μ long.

Distr. Upper Burma (Manipur), Ryu Kyu Is. (Iriomote), Micronesia (Marianas); in *Malesia*: Philippines (Luzon, Palawan), E. Java, Celebes, E. New Guinea; also in the Solomon Is., N. Queensland (Cape York Peninsula), New Caledonia, New Hebrides, and Fiji. Fig. 9.

Ecol. From about sea-level to 1000 m, in dense primary forest or rain-forest regrowth. Flowering all year round, but 52 % of all dated specimens are from June-July. Parasitizing various forest trees; hosts recorded: *Diospyros maritima* BL. (*Eben.*), *Macaranga tanarius* (L.) M.A. (*Euph.*), *Hibiscus tiliaceus* L. (*Malv.*), *Ficus austrocaledonica* BUR., *F. prolixa* FORST., *F. schlechteri* WARB. (*Morac.*), *Eucalyptus sp.* (*Myrt.*), *Linociera sp.* (*Oleac.*), *Citrus sp.* (*Rutac.*), *Vitex cofassus* REINW. *ex* BL. (*Verb.*).

Note. Distinguished from *B. abbreviata* by its leaves never being distichous and by its longer pedicels of the male flowers.

ssp. **indica** (ARN.) HANSEN, Dansk Bot. Ark. 28 (1972) 100, f. 20, 21. — *Langsdorffia indica* ARN. Ann. Nat. Hist. 2 (1838) 37. — *B. indica* (ARN.) GRIFF. Trans. Linn. Soc. 20 (1846) 95. — *B. elongata* (*non* BL.) HOOK. *f.* Trans. Linn. Soc. 22 (1856) 30, 45 *p.p. quoad specimina* WIGHT, GARDNER & THWAITES. — *B. decurrens* FAWC. Trans. Linn. Soc. Bot. II, 2 (1886) 243, t. 33, f. 1–4; ELMER, Leafl. Philip. Bot. 5 (1913) 1659; MERR. En. Philip. 2(1923) 118. — *B. dioica* (*non* R.BR. *ex* ROYLE) RIDL. J. Str. Br. R. As. Soc. 59 (1911) 165. — **Fig. 10.**

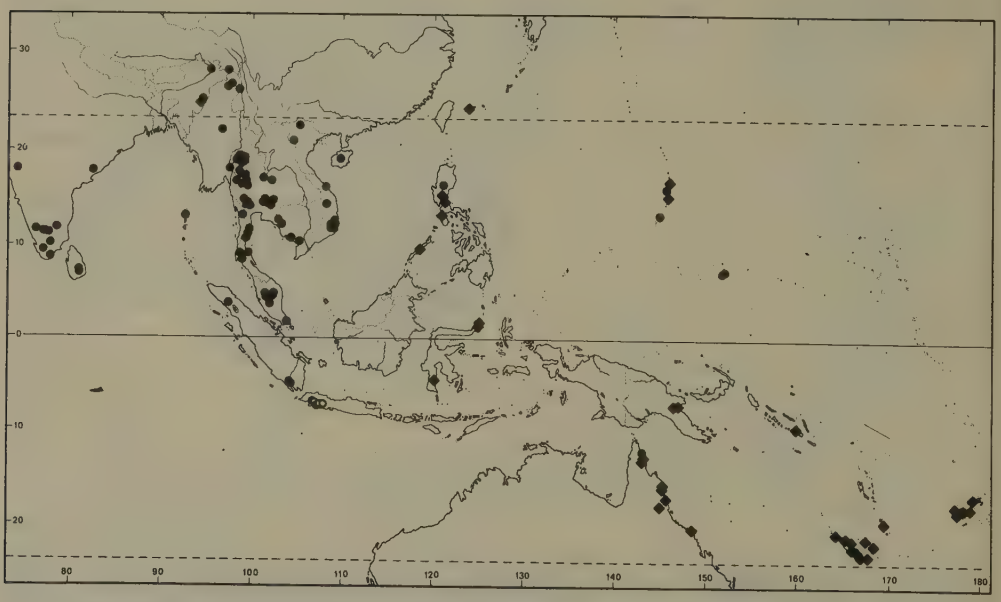

Fig. 9. Range of *Balanophora fungosa* J. R. & G. FORST. *ssp. fungosa* (■; add. E. Java), *ssp. indica* (ARN.) HANSEN *var. indica* (●), and *ssp. indica* (ARN.) HANSEN *var. globosa* (JUNGH.) HANSEN (○).

var. **indica.** — **Fig. 10.**

Dioecious plant, yellow to orange-yellow or pink. Length from fusion with host root to top of inflorescence $1^1/_4$–22 cm. *Tubers* single or in a mass more or less branched from the base. Single tuber subspherical, $^1/_2$–$5^1/_2$ cm wide and slightly shorter. Surface coarsely tessellate to fine granular, with stellate warts. Stem more or less elongated. *Leaves* 10–20, spirally arranged, imbricate, up to 3 by 2 cm, obtuse, slightly cucullate. ♂ *Inflorescence* ($^3/_4$–) 2–7 (–12) cm long and ($1^1/_4$–) 2–6 (–7) cm wide with expanded flowers, ovoid to ellipsoid.

Fig. 10. *Balanophora fungosa ssp. indica var. indica* in N. Thailand, Doi Inthanon, 1750 m (Photogr. H. P. NOOTEBOOM).

Pedicels 7–10 mm. ♂ *Flowers* subtended by truncate bracts 5 mm long and 4 mm wide, (3–) 4–5 (–6)-merous, actinomorphic. Tepals 3–7 by 1–$2^1/_2$ mm, elliptic-lanceolate, acute. Synandrium with fertile part slightly compressed, $2^1/_2$–5 mm long, anterior-posterior width 2 mm, lateral width $3^1/_2$ mm, often slightly obconical. Anthers (3–) 4–5 (–6), horseshoe-shaped. ♀ *Inflorescence* ($^1/_2$–) 1–6 (–$7^1/_4$) cm long and ($^1/_2$–) 1–4 (–$8^1/_2$) cm wide, depressed-ellipsoid, subspherical or obovoid. Spadicles (1270–) 1770 (–1960) μ long with a cylindrical lower part about 200–300 μ wide and an obovoid, obtuse or truncate top part about 600–900 μ long and 400–600 μ wide. ♀ *Flowers* on main axis of inflorescence as well as on cylindrical part of spadicles. Largest ♀ flowers with pistils (1380–) 1700 (–1920) μ long, ovaries (240–) 340 (–500) μ long and 150–350 μ wide.

Distr. Indian and Indo-Chinese subcontinents, Yunnan, Hainan; in *Malesia*: Malaya, Sumatra, Philippines (Luzon, once), also in Micronesia (Carolines, Marianas), N. Queensland (Cape York Peninsula, once). Fig. 9.

Ecol. Evergreen forest, (150–) 500–2600 m. Flowering all year round; in Malesia, the Pacific islands, and Australia 85 % of all collections are from June-Nov. Parasitizing various trees and climbers. Hosts recorded: *Carissa carandas* L. (*Apoc.*), *Ilex wightiana* WALL. *ex* WIGHT (*Aquif.*), *Euonymus crenulatus* WALL. (*Celastr.*), *Acacia melanoxylon* R.BR., *Albizia lophantha* (WILLD.) BTH., *Millettia sp.*, *Pithecellobium sp.* (*Leg.*), *Ficus sp.* (*Morac.*), *Barringtonia asiatica* (L.) KURZ (*Lecyth.*), *Syzygium cumini* (L.) SKEELS (*Myrt.*), *Cissus sp.*, *Tetrastigma sp.* (*Vitac.*).

var. **globosa** (JUNGH.) HANSEN, Dansk Bot. Ark. 28 (1972) 109, f. 24; STEEN. Mt. Fl. Java (1972) pl. 5–2. — *B. globosa* JUNGH. Nov. Act. Ac. Caes. Leop.-Car. 18, Suppl. 1 (1841) 210, t. 2; MIQ. Fl. Ind. Bat. 2 (1859) 1065; EICHL. in DC. Prod. 17 (1873) 146; KOORD. Exk. Fl. Java 2 (1912) 177, f. 39; STEEN. Trop. Natuur 23 (1934) 49; BACK. & BAKH. *f.* Fl. Java 2 (1965) 79; CORNER & WATAN. Ill. Trop. Pl. (1969) 74. — *B. gigantea* WALL. [Cat. (1832) *n.* 7249] *ex* FAWC. Trans. Linn. Soc. Bot. II, 2 (1886) 235, t. 33; RIDL. Fl. Mal. Pen. 3 (1924) 174. — *B. ramosa* FAWC. Trans. Linn. Soc. Bot. II, 2 (1886) 236, t. 34. — *Balaniella globosa* (JUNGH.) TIEGH. Ann. Sc. Nat. Bot. IX, 6 (1907) 181. — *Balaniella ramosa* (FAWC.) TIEGH. *l.c.* 181. — *Balaniella junghuehnii* TIEGH. *l.c.* 185. — **Fig. 8d, 11.**

Dioecious plant; only ♀ inflorescences observed. Length 8–10 cm from fusion with host root to top of inflorescence. Mass of tubers 8–10 cm ⌀; single tuber about 3 cm ⌀, but often indistinct. Surface

Fig. 11. *Balanophora fungosa ssp. indica var. globosa* in Tjibodas, Mt Gedeh, W. Java, 1500 m, Aug. 1913 (Photogr. KOORDERS).

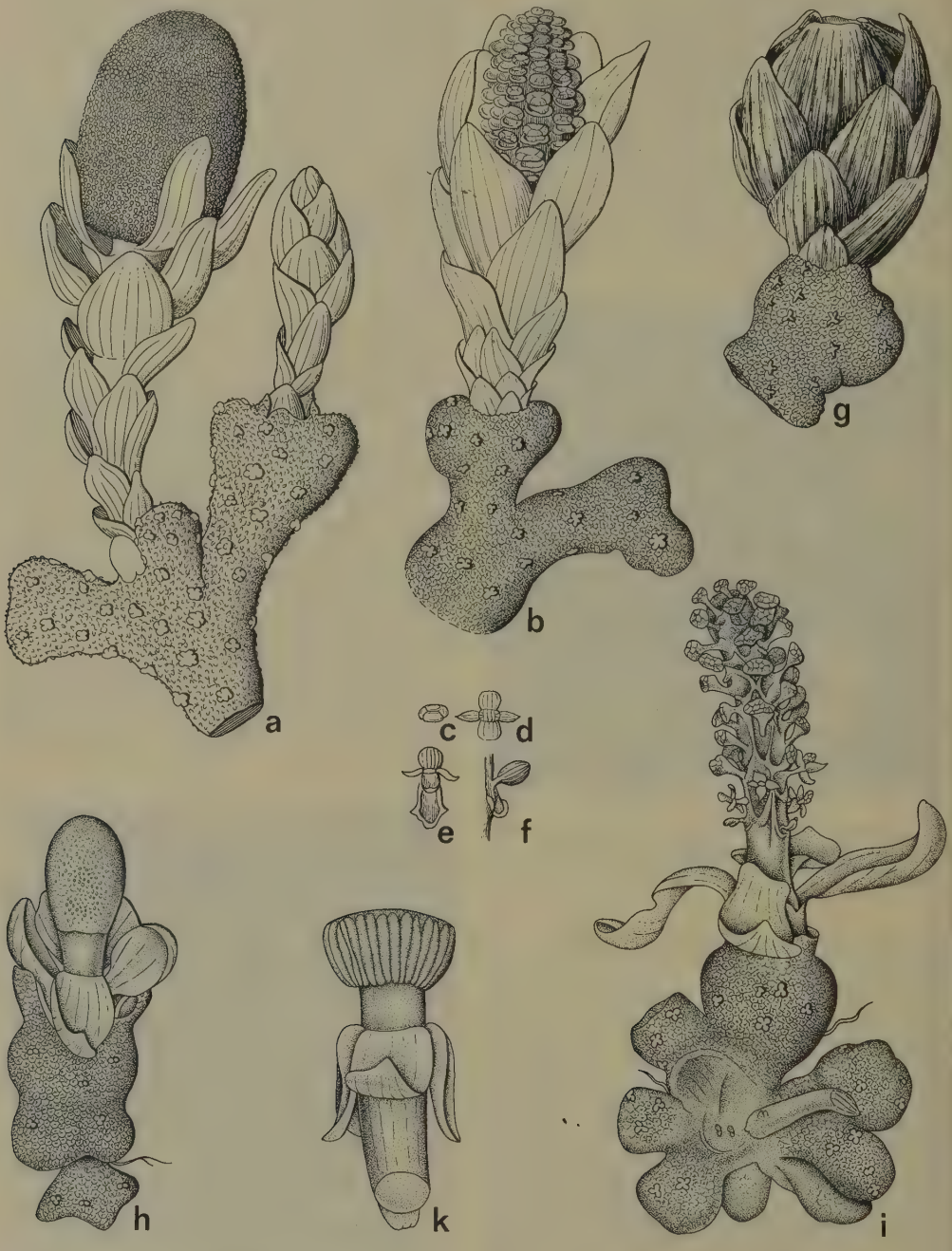

Fig. 12. *Balanophora elongata* BL. *var. elongata*. *a.* ♀ Specimen, habit, *b.* ♂ specimen, habit, *c.* ♂ flower in bud, *d.* ♂ flower fully open, seen from above, *e. ditto*, anterior view, *f. ditto*, lateral view, tepals removed. — *B. elongata var. ungeriana* (VAL.) HANSEN. *g.* Habit. — *B. papuana* SCHLTR. *h.* ♀ Specimen, habit, *i.* ♂ specimen, habit, *k.* ♂ flower, anterior view; *a–i* × $^2/_3$, *k* × 3 (*a–f* after JUNGHUHN, 1841, *g* after VALETON, 1912, *h–k* after VALETON, 1913).

coarsely tessellate with polygonate 'fields' 5–7 mm ∅. Stellate warts not distinct. Stem short and stout, 1–2 cm long only. *Leaves* 10–12, spirally arranged, imbricate, closely appressed to the stem and lower part of inflorescence, partly covering up to $^2/_3$ of flowering inflorescence. ♀ *Inflorescence* $2^1/_2$–$2^3/_4$ by $3^1/_2$–4 cm, depressed, flat-ellipsoid. Spadicles up to 2100–2500 μ long with a cylindrical lower part 200–450 μ wide and an ovoid-obovoid, obtuse or truncate top part up to 600–900 μ wide. ♀ *Flowers* on main axis of inflorescence as well as on lower part of spadicles. Largest flowers with pistils 1700–1800 μ long, ovaries 300–350 μ long and 260–280 μ wide. ♂ Inflorescences not observed. Plant apomictic.

Distr. *Malesia*: West Java only (Mt Salak east to Priangan Mts). Fig. 9.

Ecol. Evergreen forests at 1500–2000 m. Parasitizing forest trees; *Schima wallichii* (DC.) KORTH. *ssp. noronhae* (REINW. *ex* BL.) BLOEMB. (*Theac.*) has been recorded as host plant.

2. Balanophora elongata BL. En. Pl. Jav. 1 (1827) 87; MIQ. Fl. Ind. Bat. 2 (1859) 1065; Illustr. (1871) 105; EICHL. in DC. Prod. 17 (1873) 147; KOORD. Exk. Fl. Java 2 (1912) 176, f. 38; Atlas 4 (1925) t. 869, 870; Fl. Tjibodas 2 (1923) 52, *incl. var. macropanicis* VAL. ms. *ex* KOORD. *l.c.* 55; STEEN. Trop. Natuur 23 (1934) 49, f. 1, 2, 8; BACK. & BAKH. *f.* Fl. Java 2 (1965) 79; CORNER & WATAN. Ill. Trop. Pl. (1969) 72; STEEN. Mt. Fl. Java (1972) pl. 5–1a/b; HANSEN, Dansk Bot. Ark. 28 (1972) 114, f. 26, 27. — *B. dioica* (*non* R.BR. *ex* ROYLE) UNGER, Ann. Wien. Mus. Naturgesch. 2 (1837) 26, t. 2, f. 1, 2. — *B. maxima* JUNGH. Nov. Act. Ac. Caes. Leop.-Car. 18, Suppl. 1 (1841) 209, t. 1; MIQ. Fl. Ind. Bat. 2 (1859) 1065. — *B. elongata var. maxima* (JUNGH.) HOOK. *f.* Trans. Linn. Soc. 22 (1856) 45. — *B. forbesii* FAWC. Trans. Linn. Soc. Bot. II, 2 (1886) 236, t. 33, f. 8–10. — *B. multibrachiata* FAWC. *l.c.* 236, t. 34. — *Cynopsole elongata* (BL.) ENDL. *ex* JACKS. Ind. Kew. 1, 1 (1895) 688. — *Balaniella elongata* (BL.) TIEGH. Ann. Sc. Nat. Bot. IX, 6 (1907) 181. — *Balaniella maxima* (JUNGH.) TIEGH. *l.c.* — *Balaniella forbesii* (FAWC.) TIEGH. *l.c.* — *Balaniella multibrachiata* (FAWC.) TIEGH. *l.c.* — **Fig. 12–16.**

var. **elongata. — Fig. 12a–f, 13–16.**

Dioecious plant, red-yellow to coral-red or red-brown. *Tubers* repeatedly branched, single branches elongated, cylindrical, *c.* 3–8 by 1.2–1.4 cm, those producing an inflorescence slightly obconical, *c.* $1^1/_2$–2 cm wide in distal part. Surface granular to fine tessellate, with scattered stellate warts. Stem various, in ♂ specimens 1–20 cm long, shorter in ♀ specimens, $^1/_2$–$^3/_4$ cm ∅. *Leaves* 7–20, spirally arranged, imbricate, gradually increasing in size upwards, elliptic, obtuse, 1–$4^1/_2$ by $^3/_4$–$2^1/_4$ cm, colour red-yellow to red or dark red-brown, rarely butter yellow. In wet, translucent material 6–12 longitudinal nerves are seen, in dry material the leaves are faintly longitudinally striate. Upper leaves appressed to and partly concealing the flowering inflorescences or slightly reflexed in advanced stages. ♂ *Inflorescence* 3–5 cm long, rarely longer. Bracts 1–5 mm long, 5–6 mm wide, truncate. Pedicels 3–7 mm long. ♂ *Flowers* 4 (–5)-merous, bisymmetric or zygomorphic. Lateral tepals narrow, acute, 4–$4^1/_2$ by $1^1/_2$–2 mm, median tepals wide, truncate, 4–$4^1/_2$ by 3 mm. Synandrium with fertile part 2 mm long, slightly compressed, lateral width $2^1/_2$–4 mm, anterior-posterior width $1^1/_2$–2 mm. Anthers apparently straight, locules running from base to top of synandrium, longitudinally opening. Number of locules various, 20–30. ♀ *Inflorescence* ellipsoid-subspherical, 3–4 cm by $1^3/_4$–3 cm. Spadicles (880–) 985 (–1190) μ long, with a lower, cylindrical part 100–130 μ wide and an upper, ellipsoid, ovoid or obovoid part about 350–500 μ long and 270–340 μ wide. ♀ *Flowers* on main axis of inflorescence as well as on lower part of spadicles. Largest flowers with pistils (1250–) 1270 (–1300) μ long. Ovaries ellipsoid 270–300 μ by 160–180 μ.

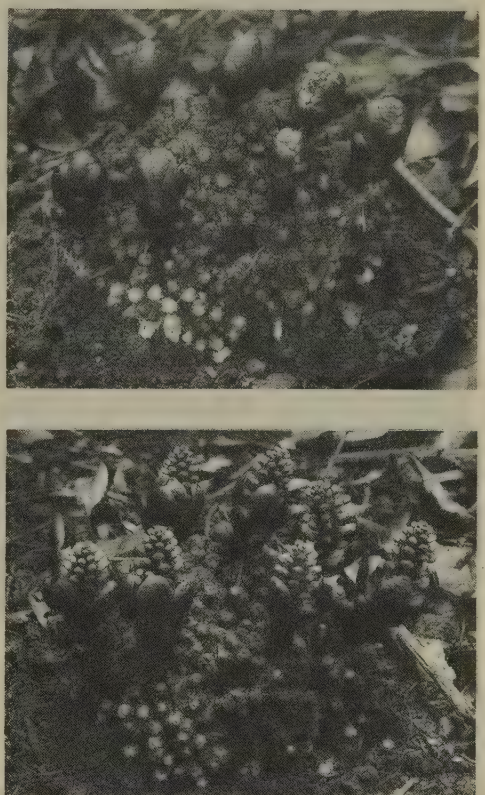

Fig. 13 & 14. *Balanophora elongata* BL. *var. elongata*. Young ♂ spadices (above), after two weeks just coming into anthesis (below), showing slow development. Tjibodas, Mt Gedeh, W. Java, 1500 m (Photogr. VAN STEENIS).

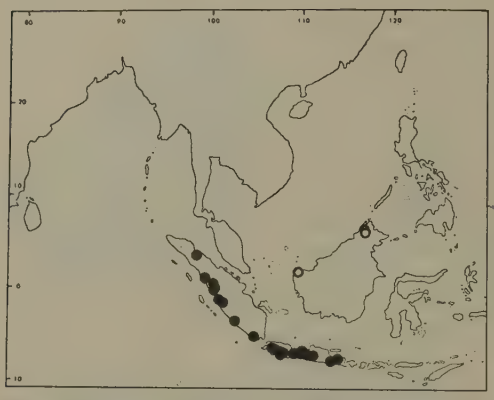

Fig. 15. Range of *Balanophora elongata* BL. (•) and *B. lowii* HOOK. *f.* (○).

Fig. 16. *Balanophora elongata* BL. *var. elongata*. Two ♀ spadices (left upper corner and lower down) and four ♂ ones. Kandang Badak, Mt Gedeh, W. Java, 2400 m (Photogr. VAN STEENIS).

Distr. *Malesia*: Sumatra and Java (most abundant in West Java). Fig. 15.

Ecol. Evergreen forest at 1000–3000 m. Parasitizing various trees and shrubs; hosts recorded: *Strobilanthes sp.* (*Acanth.*), *Macropanax dispermus* (BL.) O.K., *Schefflera aromatica* (BL.) HARMS (*Aral.*), *Rhododendron retusum* (BL.) BENN., *Vaccinium laurifolium* (BL.) MIQ., *V. lucidum* (BL.) MIQ. (*Eric.*), *Albizia lophantha* (WILLD.) BTH. (*Leg.*), *Ficus lepicarpa* BL., *F. ribes* REINW. *ex* BL., *F. septica* BURM. *f.*, *F. villosa* BL., and *Ficus sp.* (*Morac.*), *Girardinia heterophylla* (VAHL) DECNE (*Urtic.*). Flowering all year round, but 80 % of all dated specimens studied were collected in March to September.

Uses. The tubers contain wax, often in great quantity, and are used in West Java (notably Tjibodas and on Mt Gedeh) for making torches, *cf.* ULTÉE (Hand. 3rd Ned. Ind. Natuurwet. Congr. 1924, 1925, 275–276).

Note. Easily distinguished from *B. papuana* in the leaves being spirally arranged.

var. **ungeriana** (VAL.) HANSEN, Dansk Bot. Ark. 28 (1972) 120, f. 28. — *B. ungeriana* VAL. Ic. Bog. 4 (1912) 95, t. 330; STEEN. Trop. Natuur 23 (1934) 49; BACK. & BAKH. *f.* Fl. Java 2 (1965) 80. — **Fig. 12g.**

Tubers not elongated, branches short obconical. Leaves coarsely longitudinally striate.

Distr. *Malesia*: West Java (Mts Salak and Gedeh), 1400–1600 m.

Note. Male plants never seen. The tubers contain but little wax. Parasitizing various species of *Ficus*, *e.g. F. lepicarpa* BL., *F. septica* BURM. *f.*, *F. ribes* REINW. *ex* BL., and *F. villosa* BL. (*Morac.*).

3. Balanophora papuana SCHLTR, Bot. Jahrb. 50 (15 April 1913) 68, f. 1; MERR. & PERRY, J. Arn. Arb. 23 (1942) 383; HANSEN, Dansk Bot. Ark. 28 (1972) 121, f. 29, 30. — *B. elongata* (*non* BL.) STAPF, Trans. Linn. Soc. Bot. II, 4 (1894) 223. — *B. incarnata* ELMER, Leafl. Philip. Bot. 5 (13 June 1913) 1661; MERR. En. Philip. 2 (1923) 118. — *B. oosterzeeana* VAL. Nova Guinea 8 (Sept. 1913) 919, t. 161; RIDL. Trans. Linn. Soc. Bot. II, 9 (1916) 147; H. J. LAM, Nat. Tijd. N. I. 88 (1928) 277, 294; *ibid.* 89 (1929) 131; MERR. & PERRY, J. Arn. Arb. 29 (1948) 152. — *B. celebica* WARB. Die Pflanzenwelt 1 (1913) 517, f. 168B, *nom. nud.*; CORNER & WATAN. Ill. Trop. Pl. (1969) 71. — *B. decurrens* (*non* FAWC.) MERR. Philip. J. Sc. 1 (1906) Suppl. 51. — *B. multibrachiata* (*non* FAWC.) BURK. & HOLTT. Gard. Bull. S. S. 3 (1923) 72; RIDL. Fl. Mal. Pen. 3 (1924) 174; BURK. & HEND. Gard. Bull. S. S. 4 (1928) 315; MERR. Contr. Arn. Arb. 8 (1934) 54, *p.p.*; HEND. Mal. Nat. J. 6 (1951) 458, f. 413. — *Balaniella papuana* (SCHLTR) HOSOKAWA, J. Jap. Bot. 13 (1937) 202. — **Fig. 12h–j, 17.**

Dioecious plant, yellow to orange-yellow or red. Length from fusion with host root to top of inflorescences 3–15 cm. *Tubers* in a mass, 14–24 cm ∅, branching from the base into 3–12 single tubers; single tubers (1–) 2–5 (–6) cm by (1–) $1^1/_2$–3 (–4) cm; surface tessellate being covered by polygonate 'fields' 1–2 mm across, with scattered stellate warts. *Stem* with 2–4 (–5) pairs of opposite, decussate, obovate yellow to red leaves, which are patent during anthesis. In a New Guinea specimen preserved in alcohol the leaves are $3^1/_4$ by $2^1/_2$ cm with 7–11 longitudinal nerves. New Guinea and

Fig. 17. *Balanophora papuana* SCHLTR at upper Lai River, Wabag, E. New Guinea (HOOGLAND & SCHODDE 7712).

Celebes material has 4, rarely 5 leaves inserted at nearly the same level, thus appearing verticillate. In Philippine material 2–3 leaf pairs are observed, and in Borneo, Malaya, and Sumatra material 2–4 (–5) pairs. If more than 2 pairs of leaves present, the pairs are usually somewhat spaced on the stem. The leaves are always nearly of the same size. ♂ *Inflorescence* $2^1/_2$–5 by $1^1/_2$–3 cm with expanded flowers. Bracts rudimentary, at most 1 mm long. Pedicels 2–7 mm long. *Flowers* often in conspicuous vertical rows, bisymmetric or zygomorphic on account of lateral elongation, 4 (–5)--merous. Median tepals wide and truncate, $4^1/_2$ by $3^1/_2$ mm. Lateral tepals narrow and acute, $4^1/_2$ by 1 mm. Synandrium with fertile part often slightly obconical, laterally elongated, *e.g.* length 3 mm, anterior-posterior width 3 mm and lateral width 7 mm. Anther cells parallel, running from base to top of synandrium, longitudinally opening. ♀ *Inflorescence* obovoid, ($^3/_4$–) $1^1/_2$–3 (–4) by ($^1/_2$–) 1–$2^1/_2$ (–3) cm. Spadicles (900–) 1000 (–1200) μ long with a cylindrical lower part about 600 μ long and 100 μ wide and an obconical upper part about 400 μ long and 200–300 μ wide. ♀ *Flowers* chiefly on main axis of inflorescence but always a few also on lower part of spadicles. Largest flowers with pistils *c.* 1150 μ, ovaries *c.* 180 μ long and 140 μ wide.

Distr. *Malesia*: Malaya, NW. Borneo (Mts Murud, Kinabalu), Celebes, Philippines (Luzon, Mindoro, Mindanao), and New Guinea. Fig. 18.

Ecol. Evergreen mountain forests at (300–) 1000–2000 m. Parasitizing roots of forest trees. Hosts recorded: *Macaranga sp.* (*Euph.*), *Ficus sp.* (*Morac.*). Flowering all the year round, 66 % of dated collections from June-Nov.

Note. Distinguished from *B. lowii* by the fewer leaves which are nearly equal in size and not concealing the flowering inflorescence, from *B. elongata* by the leaves being opposite and almost equal.

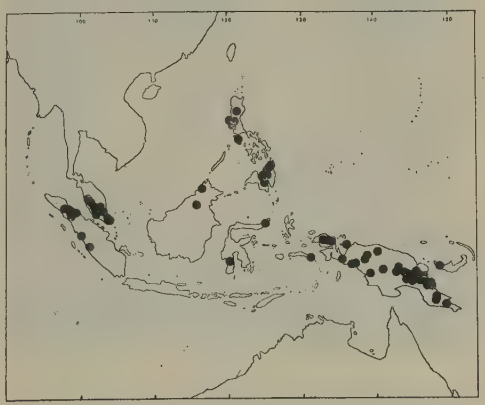

Fig. 18. Range of *Balanophora papuana* SCHLTR.

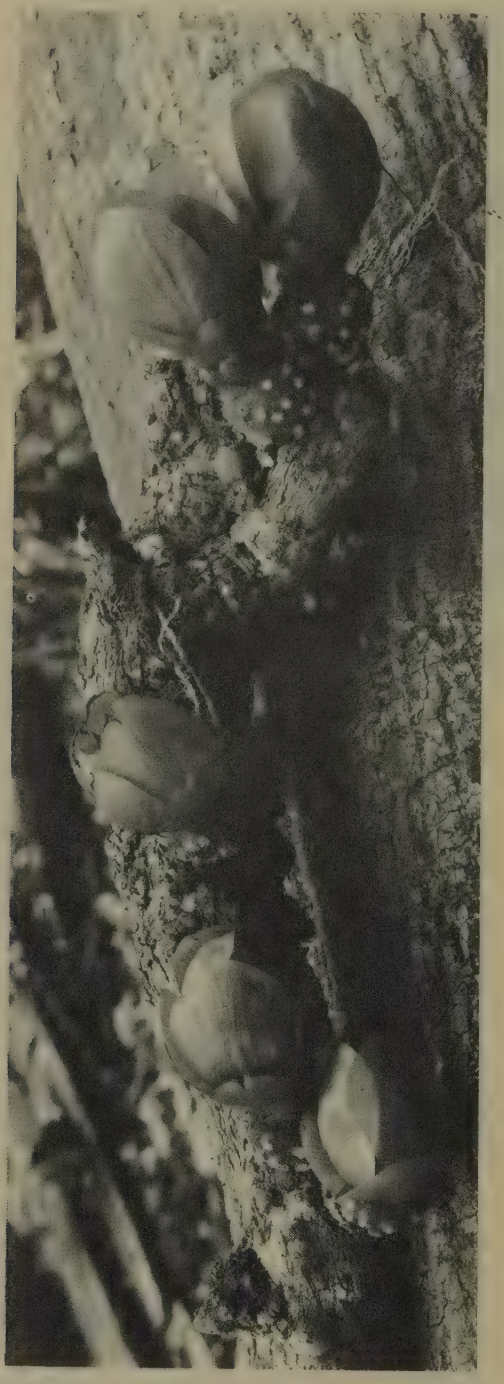

Fig. 19. *Balanophora lowii* HOOK. *f.* at Mesilau River, Mt Kinabalu, N. Borneo (Photogr. CORNER).

4. Balanophora lowii HOOK. *f.* Trans. Linn. Soc. 22 (1859) 426, t. 75; EICHL. in DC. Prod. 17 (1873) 148; HANSEN, Dansk Bot. Ark. 28 (1972) 127, f. 31, 32. — *Balaniella lowii* (HOOK. *f.*) TIEGH. Ann. Sc. Nat. Bot. IX, 6 (1907) 181. — **Fig. 19.**

Dioecious plant, yellow to red. Length from fusion with host root to top of upper leaves about 9 cm. *Tubers* always single in the material studied, spherical, $1^1/_2$–$2^1/_2$ cm ∅, surface granular with scattered to numerous stellate warts. *Leaves* 12–16, deep pink, opposite, decussate, gradually increasing in size upwards, the basal ones being small and bract-like, while the upper 2–3 pairs are ovate to almost orbicular, $2^1/_2$–$4^1/_4$ by $2^1/_2$–4 cm. In wet material 8–14 longitudinal nerves are easily observed; the nerves are forking in the middle part of the lamina. The upper 2–3 pairs of leaves conceal the flowering inflorescence completely. ♂ *Inflorescence* subspherical-ellipsoid, $2^1/_2$–$2^3/_4$ by $2^1/_2$ cm. Bracts 2 mm long and 5 mm wide, truncate or almost rudimentary. Pedicels 6–7 mm long. ♂ *Flowers* bisymmetric or zygomorphic through lateral elongation, 4 (–5)-merous. Median tepals 5 mm by 4 mm, truncate. Lateral tepals 5 by $2^1/_2$–3 mm, acute. Synandrium with fertile part slightly laterally elongated, 3 mm long, anterior-posterior width $3^1/_2$ mm, lateral width 5 mm. Anther cells parallel, running from base to top of synandrium, longitudinally opening. ♀ *Inflorescence* ellipsoid, $3^1/_4$ by $2^1/_4$ cm. Spadicles 1100–1500 μ long, with a cylindrical lower part *c.* 180–230 μ wide and an obovoid to truncate upper part, 320–380 μ wide. Largest flowers with pistils 1450–1750 μ long, ovaries 240–320 μ long, ellipsoid.

Distr. *Malesia*: Borneo (Mt Kinabalu; Sarawak: Poi Range, G. Berumput). Fig. 15.

Ecol. Collected in evergreen forests at 1000–3000 m. Parasitizing roots as well as supraterraneous stem parts. Host(s) not yet recorded. Season probably all year round, but more records are needed.

Note. Distinguished from *B. papuana* by its higher number of leaves and by the leaves being gradually increasing in size upwards on the stem, from *B. elongata* by its opposite leaves.

5. Balanophora reflexa BECC. Att. Soc. Ital. Sc. Nat. 11 (1868) 198; Nuov. Giorn. Bot. Ital. 1 (1869) 65, t. 2–4; EICHL. in DC. Prod. 17 (1873) 148; BECC. Wanderings (1904) 128, 164; VAL. Nova Guinea 8 (1913) 920; HANSEN, Dansk Bot. Ark. 28 (1972) 130, f. 33, 34. — *Balaniella reflexa* (BECC.) TIEGH. Ann. Sc. Nat. Bot. IX, 6 (1907) 182. — *B. fasciculigera* SUESSENG. & HEINE, Mitt. Bot. Staatssamml. Münch. 2 (1950) 57; HEINE in Fedde, Rep. 54 (1951) 226. — **Fig. 8e–g, 20.**

Dioecious plants, rich orange to red or dark red. Length from fusion with host root to top of inflorescence in ♂ plants (4–) 5–10 (–11) cm, in ♀ plants (6–) 7–10 (–23) cm. *Tubers* several together in a mass branching from the base into single tubers. Single tubers elongated, cylindrical or ovoid-ellipsoid-obovoid, (2–) 3–6 (–14) cm long and

Fig. 20. *Balanophora reflexa* BECC. at Balleh River, Bt Tikang, Sarawak (Photogr. J. A. R. ANDERSON).

(1½–) 2–4 (–4½) cm wide. Surface coarsely tessellate. *Leaves* 3–8, spirally arranged, length 2–3½ cm, width 1½–2¼ cm. ♂ *Inflorescence* 1¾–2½ cm long. Bracts various: upper bracts entire, truncate, 3–4 mm long, lower bracts divided to the base into 4–6 (–7) teeth, each about 1–2 by ½ mm. Pedicels of lowermost flowers (1–) 1½–1¾ (–2) cm, compressed, 3 by 2 mm in cross-section, before anthesis pointing upwards and closely appressed to the axis of the inflorescence, during and after anthesis strongly reflexed. *Flowers* 7–9 or more. Buds much compressed, length (3¾–) 5–6 (–7) mm, lateral width (4½–) 6–8 (–9) mm, anterior-posterior width (2½–) 3 (–3½) mm. ♂ *Flowers* 4-merous, bisymmetric or zygomorphic on account of lateral elongation. Median tepals 2, wide, almost square, truncate. Lateral tepals 2, narrow, lanceolate, acute. Synandrium with fertile part much compressed, almost fan-shaped. Anther cells parallel, running from base to top of synandrium. ♀ *Inflorescence* spherical or ellipsoid-obovoid, (1–) 1½–3 (–5) by (¾–) 1–2 (–3) cm. Spadicles (800–) 1000 (–1200) μ long, long-obconical with top part rounded, about 100 μ wide at base and 250–270 μ wide at top. ♀ *Flowers* on main axis of inflorescence only. Largest flowers about 1150 μ long, ovaries about 270 μ long.

Distr. *Malesia*: Borneo (Sarawak, W. Borneo, Mt Kinabalu) and Malaya (Pahang, one collection). Fig. 24.

Ecol. In evergreen forest on roots of trees at altitudes from 300–3000 m. Host recorded: *Elatostema sp.* (*Urtic.*), parasite appearing on subterraneous stem parts of host. Flowering all year round.

Note. Distinguished from all other species by the long, reflexed pedicels and the extremely compressed, almost sharp-edged, fan-shaped synandria. Flowering specimens sometimes smelling strongly of fox (CORNER on label).

6. Balanophora abbreviata BL. En. Pl. Jav. 1 (1827) 87; MIQ. Fl. Ind. Bat. 2 (1859) 1065; EICHL. in DC. Prod. 17 (1873) 148; F.-VILL. & NAVES, Nov. App. Blanco Fl. Filip. ed. 3, 1 (1880) 185; KOORD. Exk. Fl. Java 2 (1912) 176, f. 37; STEEN. Arch. Hydrobiol. Suppl. 11 (1932) 301; Trop. Natuur 23 (1934) 49; BACK. & BAKH. *f.* Fl. Java 2 (1965) 79; HANSEN, Dansk Bot. Ark. 28 (1972) 134, f. 32. — *B. alutacea* JUNGH. Nov. Act. Ac. Caes. Leop.-Car. 18, Suppl. 1 (1841) 205; MIQ. Fl. Ind. Bat. 2 (1859)

Fig. 21. *Balanophora abbreviata* BL. in limestone cave, Castle Hill, Cape Vogel Peninsula, NE. New Guinea (Photogr. HOOGLAND 4334).

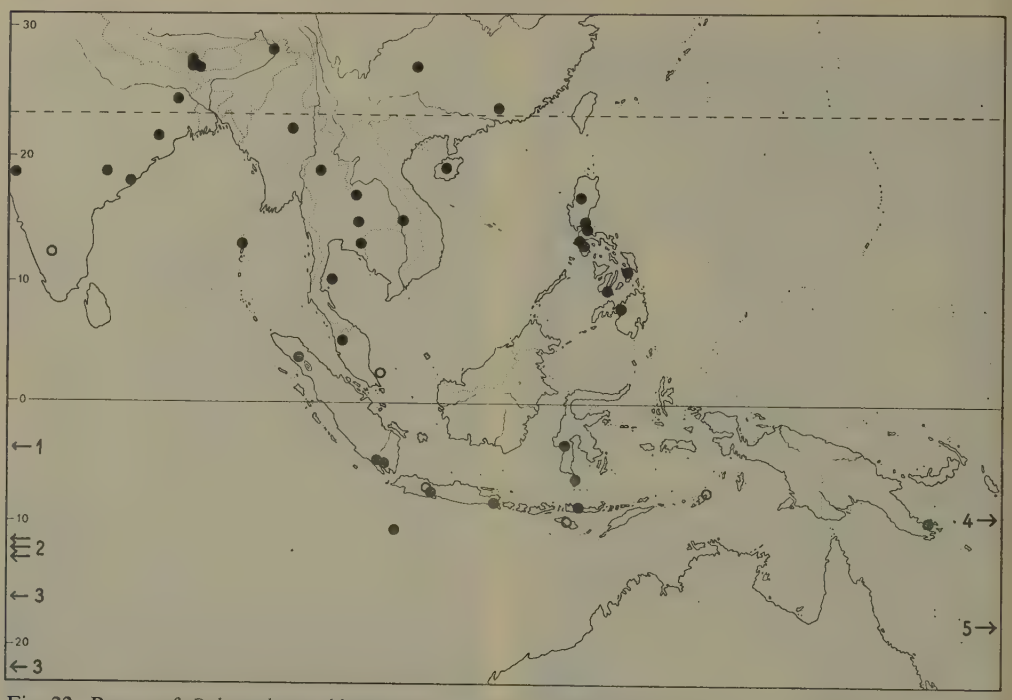

Fig. 22. Range of *Balanophora abbreviata* Bl. (• specimens studied, ○ from literature). Occurrence outside map: 1. Africa (Congo), 2. Comores, 3. Madagascar, 4. Marquesas, 5. Tahiti.

1064; Elmer, Leafl. Philip. Bot. 5 (1913) 1659. — *B. zollingeri* Fawc. Trans. Linn. Soc. Bot. II, 2 (1886) 234, t. 34. — *B. micrantha* Warb. in Perkins, Fragm. Fl. Philip. (1905) 169; Elmer, Leafl. Philip. Bot. 5 (1913) 1659; Merr. En. Philip. 2 (1923) 118. — *B. insularis* Ridl. J. Str. Br. R. As. Soc. 45 (1906) 218; Fl. Mal. Pen. 3 (1924) 175. — *B. trimera* Tiegh. Ann. Sc. Nat. Bot. IX, 6 (1907) 148. — *Balaniella abbreviata* (Bl.) Tiegh. *l.c.* 181. — *Balaniella alutacea* (Jungh.) Tiegh. *l.c.* 181. — *B. fawcettii* Elmer, Leafl. Philip. Bot. 5 (1913) 1659. — *B. subglobosa* Elmer, *l.c.* 1660; Merr. En. Philip. 2 (1923) 118. — *Acroblastum fawcettii* (Elmer) Setch. Un. Cal. Publ. Bot. 19 (1935) 146. — *Acroblastum insulare* (Ridl.) Setch. *l.c.* 147. — *Acroblastum subglobosum* (Elmer) Setch. *l.c.* 147. — *B. sarasinorum* Warb. *ex* Harms in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 333, *nom. nud.* — **Fig. 21.**

Monoecious plants (inflorescences bisexual), creamy-white to pale yellow. Length from fusion with host root to top of inflorescence (3–) 5–10 (–15) cm. *Tubers* single, or several together in a mass, branching from the base. Single tubers obconical, narrow at base, broadening near top to (1–) 1.7 (–2) cm, length (1–) $2^1/_2$ ($-3^1/_2$) cm. Surface fine granular, with or without scattered stellate warts. *Leaves* 3–7, distichous, evenly spaced, slightly imbricate 1–2 by $^3/_4$–$1^1/_2$ cm, ovate, obtuse or emarginate. ♂ *Flowers* 10–20, in a zone $^1/_2$–2 cm high below ♀ part of inflorescence (Hainan material with a few (3–8) ♂ flowers also at top of the ♀ part). Pedicels extremely short, *c.* 1 mm, or flowers sessile. ♂ *Flower* (3–) 4–5 (–8)-merous, bisymmetric or slightly to conspicuously zygomorphic on account of lateral elongation. A 4-merous flower will have 2 narrow, ovate, acute lateral tepals, and 2 wide, truncate, almost square median tepals. Length of tepals $1^1/_2$–2 mm. Synandrium with fertile part about 1 mm long, slightly compressed, lateral width $1^1/_2$–2 mm, anterior-posterior width $^1/_2$–$^3/_4$ mm. Anthers divided into 16–20 parallel loculi, running from base to top of synandrium, or the loculi may be transversally divided into smaller locelli. ♀ *Inflorescence* ovoid, (1–) $1^1/_2$ ($-2^1/_2$) by ($^1/_2$–) 1 ($-2^1/_4$) cm. Spadicles 850–1000 μ long with a lower cylindrical part 140–180 μ wide, and an upper, obconical, truncate, part 400–500 μ wide. ♀ *Flowers* on main axis of inflorescence as well as on lower part of spadicles. Largest flowers with pistils 950–1100 μ long, ovaries ovoid to ellipsoid, 300–450 μ by 175–250 μ.

Distr. Africa (Congo), Comores, Madagascar, SW. China, Hainan, Indian and Indo-Chinese subcontinents, Andamans, throughout *Malesia* (but very scattered and not yet known from Borneo and the Moluccas), and in the Pacific (Tahiti, Marquesas). Fig. 22.

Ecol. From about sea-level to 1000 m, mostly in evergreen forests. Flowering season in Malesia May-Jan. Hosts recorded: *Tetrameles nudiflora* R.Br. (*Datisc.*), *Hibiscus tiliaceus* L. (*Malv.*), *Ficus*

baroni BAKER, *F. cocculifolia* BAKER *ssp. sakalavarum* BAKER, *F. tinctoria* L. *f.* (*Morac.*).

Note. Distinguished from *B. fungosa ssp. fungosa* by its distichous leaves and by the pedicels of ♂ flowers being very short or absent. Flowering specimens may occur 3 m high above the soil in *Ficus* specimens (RANT *in sched.*).

7. Balanophora latisepala (TIEGH.) LECOMTE, Fl. Gén. I.-C. 5 (1915) 228; HANSEN, Dansk Bot. Ark. 28 (1972) 140, f. 37, 38. — *Balaniella latisepala* TIEGH; Ann. Sc. Nat. Bot. IX, 6 (1907) 184. — *B. truncata* RIDL. J. Linn. Soc. Bot. 41 (1913) 296; Fl. Mal. Pen. 3 (1924) 174; BURK. & HEND. Gard. Bull. S. S. 3 (1925) 419; CALDER *et al.* Rec. Bot. Surv. India 11 (1926) 16; HEND. Gard. Bull. S. S. 4 (1927) 102. — *B. multibrachiata* (*non* FAWC.) HEND. J. Mal. Br. R. As. Soc. 5 (1927) 266; MERR. Contr. Arn. Arb. 8 (1934) 54 p.p. — **Fig. 23.**

Dioecious plants (inflorescences unisexual), yellowish white to yellow or grey. Length from fusion with host root to top of inflorescence 10–25 cm. *Tubers* in a mass, branching from the base. Single tuber subspherical-ellipsoid, 2–$4^1/_4$ by $1^3/_4$–$2^1/_2$ cm. Surface of tubers fine granular with few to numerous stellate warts. Stem mostly long and slender, $^3/_4$–$1^1/_4$ cm ⌀ below inflorescence.

Fig. 23. *Balanophora latisepala* (TIEGH.) LEC. left, ♂ right (after HANSEN, 1972, 141–142, fig. 37–38), both × $^3/_4$.

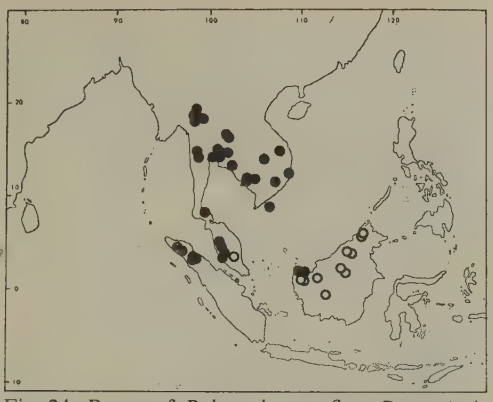

Fig. 24. Range of *Balanophora reflexa* BECC. (○) and *B. latisepala* (TIEGH.) LEC. (●).

Leaves 3–4 (–6), well spaced, distichous, patent. ♂ *Inflorescence* long-ellipsoid, 5–9 cm long and $1^1/_2$–$2^1/_2$ cm wide with flowers expanded. Bracts truncate, *c.* 3 mm long and 5 mm wide, sometimes with the middle part reduced and thus appearing like two teeth. Pedicels ($1^1/_2$–) 2–3 (–6) mm long. ♂ *Flowers* bisymmetric or zygomorphic on account of lateral elongation and correspondingly compressed in anterior-posterior direction, 4–5 (–9–14)-merous. A normally developed 4-merous flower will have two narrow, ovate, acute lateral tepals 3–$3^1/_2$ by $1^1/_2$–2 mm and two wide, nearly square, truncate median tepals 3–$3^1/_2$ by 3–4 mm. In a 5-merous flower the upper median tepal is normally split into two. Higher numbers of tepals may be caused by further splitting up of median tepals or simply by fusion of neighbouring flowers. Synandrium with fertile part laterally elongated, somewhat compressed in anterior-posterior direction. Anther cells 16–20 or more, parallel, always running from base to top of synandrium, opening longitudinally. ♀ *Inflorescence* (1–) 4–6 (–7) cm long and ($^1/_2$–) 1–$1^1/_2$ (–2) cm wide, long-ellipsoid or almost cylindrical with obtuse top part. Spadicles (730–) 1050 (–1270) μ long, lower part cylindrical, *c.* 100 μ wide, upper part obovoid, 300–600 μ wide, about $^1/_3$ of total length of spadicle. ♀ *Flowers* on main axis of inflorescence as well as on spadicles, the largest flowers being those on the main axis. Largest flowers with pistils (845–) 1070 (–1300) μ long. Ovaries ovoid, (300–) 360 (–400) μ long.

Distr. Indo-China, Thailand, in *Malesia*: Malaya, N. Sumatra, Borneo (Sarawak, twice). Fig. 24.

Ecol. In various kinds of forest, from 1200–1700 m. Flowering season in Malaya, Sumatra, and Borneo probably all year round, but more records are necessary. Parasitizing various trees and climbers. Hosts recorded: *Gymnema sp.* (*Ascl.*), *Bambusa sp.* (?) (*Gram.*), *Ficus religiosa* L. (*Morac.*), *Sterculia sp.* (*Sterc.*), *Tetrastigma sp.* (*Vitac.*).

Note. Distinguished from *B. polyandra* in the anther cells not being transversally divided into smaller locelli.

4. LANGSDORFFIA

MART. in Eschw. J. Bras. 2 (1818) 179; Nov. Gen. Sp. Pl. 3 (1832) 182; ENDL. Gen. Pl. (1836) 74; KLOTZSCH, Linnaea 20 (1847) 460; HOOK. *f.* Trans. Linn. Soc. 22 (1856) 29; EICHL. in Mart. Fl. Bras. 4, 2 (1869) 9; in DC. Prod. 17 (1873) 140; HOOK. *f.* in B. & H. Gen. Pl. 3 (1880) 236; ENGL. in E. & P. Nat. Pfl. Fam. 3, 1 (1889) 262; HARMS in E. & P. Nat. Pfl. Fam. ed. 2, 16b (1935) 335, f. 169. — **Fig. 25, 26.**

Herbaceous, fleshy parasites. *Tubers* elongated, cylindrical, somewhat swollen at point of contact with the host root, more or less hairy. *Inflorescences* appearing endogenously from the cylindrical parts of tubers, basally surrounded by an irregularly lobed sheath. *Stem* in lower part with numerous spirally arranged, triangular to narrowly triangular, pergamentaceous, acute scales, exceeding the flowers; flower-bearing apex of stem flattish or slightly convex. *Inflorescences* unisexual with trimerous, pedicellate ♂ flowers or with very numerous ♀ flowers apparently laterally connate in their lower parts, having a short tubular perianth and one style.

Distr. 3 *spp.*, one in Madagascar (*L. malagasica* (FAWC.) HANSEN, Bot. Tidsskr. 69, 1974, 59), one in Malesia (New Guinea), and one in Central and tropical South America (*L. hypogaea* MART.). Fig. 6.

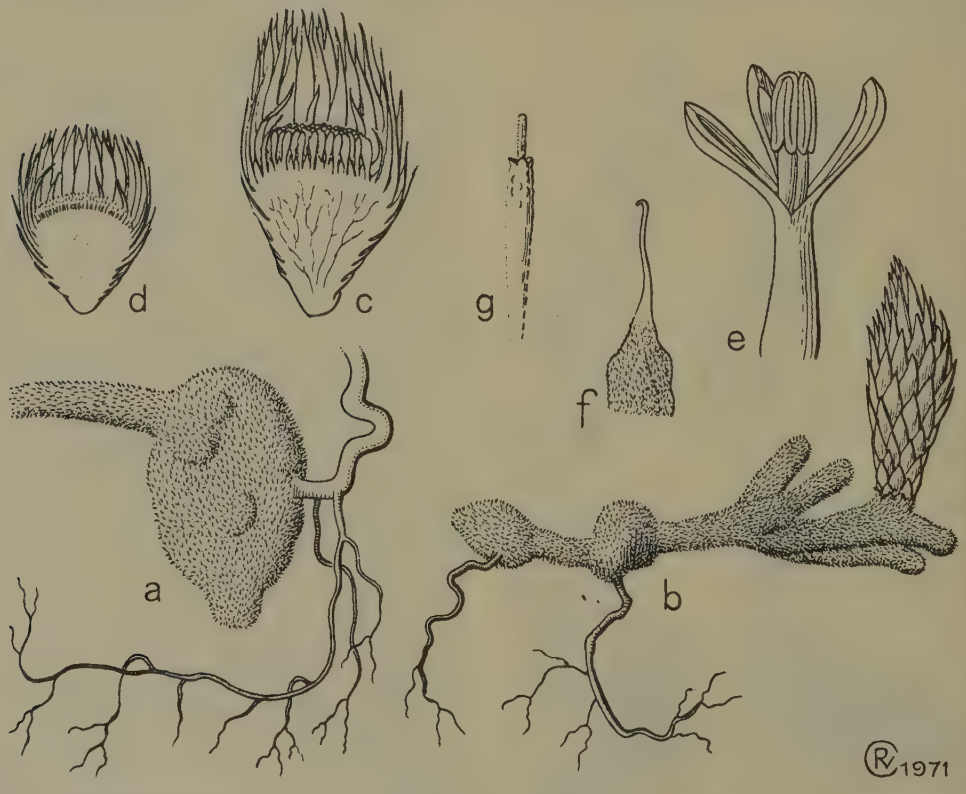

Fig. 25. *Langsdorffia papuana* GEESINK. *a.* Swollen part of tuber with part of root of the host, *b.* tuber with young inflorescence, *c.* LS through a nearly full-grown ♂ capitulum, *d. ditto*, ♀ capitulum, all × 1/2, *e.* ♂ flower, *f.* reduced scale between ♂ flowers, both × 3, *g.* ♀ flower, × 6 (after GEESINK, 1972).

1. Langsdorffia papuana GEESINK, Acta Bot. Neerl. 21 (1972) 104, f. 1 — *Langsdorffieae indet.*: WOMERSLEY & STREIMANN, Proc. Papua & New Guinea Sci. Soc. 22 (1970) 31–34. — **Fig. 25, 26.**

Yellowish to reddish parasites with unisexual inflorescences. *Tuber* cylindrical, *c.* 1 cm ⌀, swollen up to 3 cm ⌀ at the point of contact with host root, densely patently hairy, less so at swollen parts. *Inflorescences* surrounded at base by a 5–8-lobed sheath. Inflorescence-bearing stem obconical, $2^1/_2$–5 cm long, in upper part 3–5 cm ⌀, in lower part *c.* 1 cm ⌀, with numerous adpressed, pergamentaceous, imbricate, scaly leaves. *Leaves* creamy stramineous to reddish with brown tips, lower ones triangular $^1/_2$ by $^1/_2$ cm, upper ones narrowly triangular, up to 5 by 1 cm. ♂ *Inflorescence* carrying among the flowers reduced, reddish scales with a papillose base. ♂ *Flowers* 1 cm by 3 mm when not expanded, creamy yellow. Pedicels $^3/_4$ cm. Tepals (2–) 3, elliptic, boat-shaped, valvate, *c.* $^3/_4$ cm by 3 mm. Stamens (2–) 3, epitepalous, filaments united into a tube *c.* $2^1/_2$ mm long. Anthers with their connectives united up to $^1/_3$ of their length, ovate-elliptic, emarginate at the base, rounded at apex, *c.* 4 by 2 mm, 2-celled and horseshoe-shaped with the bend upwards. ♀ *Flowers* inserted very close to each other, apparently laterally connate in lower parts. Style up to halfway surrounded by a tubular, apically shortly 4–6-lobed perianth up to 1.3 by 0.4 mm; exserted part of the style *c.* 1.3 by 0.2 mm, surface cells somewhat swollen. Ovary apparently without cavity. The diaspore consists of embryo + endosperm surrounded by 2–3 layers of sclereid cells and is dispersed upon the decay of the infructescence.

Distr. *Malesia*: E. New Guinea. Fig. 6.

Ecol. Parasitizing roots of *Vaccinium sp.* (*Eric.*), *Eugenia sp.*, *Metrosideros eugenioides* (SCHLTR) STEEN. (*Myrt.*) and *Meliosma pinnata* (ROXB.) WALP. (*Sab.*). Upper part of flowering heads appears above humus layer in *Nothofagus* forest at 1500 m.

Fig. 26. *Langsdorffia papuana* GEESINK. New Yamap, Head of Baime Creek, Wau Subdistr., E. New Guinea (7° 08′ S, 146° 46′ E), 1500 m, two spadices, one in bud (above, 4 cm wide), one in anthesis (below) (Photogr. STREIMANN, NGF 44461).

Doubtful

Cynomorium philippinense BLANCO, Fl. Filip. (1837) 665; ed. 2 (1845) 464; ed. 3, 3 (1879) 72; MERR. Sp. Blanc. (1918) 134; En. Philip. 2 (1928) 119.

This is a *Balanophora*. According to the description it is a monoecious plant, and might belong to *B. fungosa*, but the imperfect description makes identification uncertain.

TACCACEAE (E. Drenth, Leyden)

The affinity of *Taccaceae* has been subject to diverse opinions, many authors favouring a place near *Dioscoreaceae*, but in my view the unisexual flowers, the branching habit, the racemose inflorescences and the 3-celled ovary in that family make this not very probable. I prefer to share the opinion of those who seek its affinity to *Amaryllidaceae*, because of the habit, the scape-shaped inflorescence, the umbellate flower disposition with an involucre, and the fact that in that family also occasionally a 1-celled ovary is found. Neither the systematic anatomy nor the inadequately known phytochemistry or chromosome number are sufficiently diagnostic to support opinions on affinity.

Before my precursory revision (1972) two genera were distinguished, *viz Tacca* and a monotypic genus, *Schizocapsa* (*S. plantaginea* HANCE) ranging from Thailand to Kweichow, which differs only by having dehiscent capsular fruits instead of the indehiscent ones in Tacca. I have seen since that this species has dehiscing fruit indeed, which removes my doubt (*l.c.* 370) on this point. I have tried to see whether there may be a tardy dehiscence in *Tacca* by keeping fruit stalks of *T. chantrieri* in erect position in the Leyden greenhouse, but this had no result. I see no reason to keep *Schizocapsa* as a separate genus or infrageneric taxon.

TACCA

J. R. & G. FORST. Char. Gen. Pl. (1775) 35, *nom. cons.*; PAX in E. & P. Nat. Pfl. Fam. 2, 5 (1887) 127; LIMPR. Inaug. Diss. Breslau (1902) 43; Pfl. R. Heft 92 (1928) 13; DRENTH, Blumea 20 (1972) 367, see there for further synonyms. — *Leontopetaloides* BOEHMER in Ludwig, Def. Gen. Pl. (1760) 512, *nom. rejic.* — *Ataccia* PRESL, Reliq. Haenk. 1, 3 (1828) 149. — **Fig. 1–11.**

Terrestrial, erect, perennial, mostly rosulate, scapose herbs. *Rhizome* tuberous, solid, starchy, globose or elongate, either with apical growth or with spaced growing points. *Leaves* up to 13, appearing together with the inflorescence, either spaced or crowded on the rhizome, petioled, entire, pinnatifid, palmatipartite or palmatisect and palmatisect with pinnately divided segments; herbaceous to chartaceous; nervation palmate or pinnate; venation reticulate; petioles erect, ribbed, canaliculate distally, glabrous, with a sheathing base, solid, rarely hollow. *Inflorescences* umbellate, involucrate, sometimes bracteate; peduncle(s) (scape) simple, solid, very rarely hollow, erect, ribbed, distally canaliculate. *Involucral bracts* mostly 4 in 2 whorls (in *T. leontopetaloides* 4–12, in *T. bibracteata* 2), herbaceous, mostly erect, the outer ones mostly longer persisting after anthesis than the inner ones which are likewise originating later in the young stage of growing, always flattened, entire, parallel- or curvinerved, sometimes also pinnately nerved. *Floral bracts*, if present, filiform, never flattened, of the same number as the flowers, caducous after anthesis. *Flowers* actinomorphic, bisexual, epigynous, gamophyllous, with 6 lobes in 2 whorls, imbricate in bud, mostly very dark coloured, parallel- or curvinerved; pedicels 6-ribbed, elongated and thickened in fruit. *Stamens* 6, inserted on the corolla tube, epitepalous, outer ones slightly larger than inner ones; filaments short and flattened, at the base — except for the margins, which are inflexed — adnate to the perianth tube, this portion rhomboid in outline; the free portion helmet-shaped; thecae placed at the inner side of the helmet, introrse, lengthwise dehiscent. *Ovary* 1-celled, 3-carpellate, obpyramidal, 6-ribbed;

placentas 3, parietal, each with ∞ pendulous, apotropous-anatropous ovules; disk sometimes present; style 1, provided with 3 — sometimes deeply — incised wings, its apex with 3 obcordate lobes, each provided with a clear stigmatic canal. *Fruits* berry-like, with a fleshy pericarp, 6-ribbed, irregularly desintegrating, rarely (in one extra-Mal. *sp.*) dehiscent. *Seeds* completely filling the fruit, 10-∞, with a strongly ribbed, mostly glabrous testa and a mostly distinct raphe.

Distribution. Ten species, pantropical, within the tropics of Cancer and Capricorn, mainly developed in *Malesia*, where 8 out of 9 Old World species occur; 1 species in tropical South America. Fig. 1.

Ecology. Mostly on the floor of moist evergreen primary and secondary forests, but *T. palmata* also under seasonal climatic conditions for example in teak forest, and possibly *T. chantrieri* also in seasonal or dry evergreen forest in SE. Asia, not bound to special soil types. *T. leontopetaloides* has a far wider distribution and deviates from the other species in rarely occurring in primary forest but preferring secondary forest and thickets, and many open situations, clearings, grassland, savannah, coconut groves, and beach vegetation (*Barringtonia* formation), not shunning seasonally dry areas, such as teak and eucalypt woodland; its originally native habitat is probably the beach forest, but because of the food value of its tubers it is likely that it has been dispersed by man since time immemorial and though this can no longer be traced and proved it is likely that a great part of its range has been effected by man.

As to altitude, most species are restricted to the lowlands ascending to *c.* 1000 m; *T. palmata*, however, has been found up to 1200 (–1500) m.

Flower biology. The syndrome of sapromyophily as described by FAEGRI & VAN DER PIJL (Principles of pollination ecology, 1966, 87–90) is clearly apparent in *Taccaceae*. There is an ecological group of *Diptera* attracted to blossoms by the 'impression of decaying substance', no adaptation of the flies for flower visits is present; 'the basis for the visit is deceit'. The adaptations of the plant are found in the inflorescence or in the flowers. Generally, the colours are dull, dark, brown-purple-greenish, these colours having under ordinary circumstances no attraction for this class of pollinators, *viz* the carrion and dung flies, but the same colours do possess a positive attraction value in the presence of the odour of decaying protein. These characters are present in *Taccaceae* (colours) or possible (odour) as we see in the flowers a large number of glandular epidermal cells. The flies find in the flowers openings through which they can crawl inside. An attraction point is here the light inner side of the flowers, which functions as a kind of window, towards which the insects crawl. As, however, the *Tacca* flowers have nothing to offer to the visitors, the latter will soon try to leave the flower. The structure of the flowers makes this difficult,

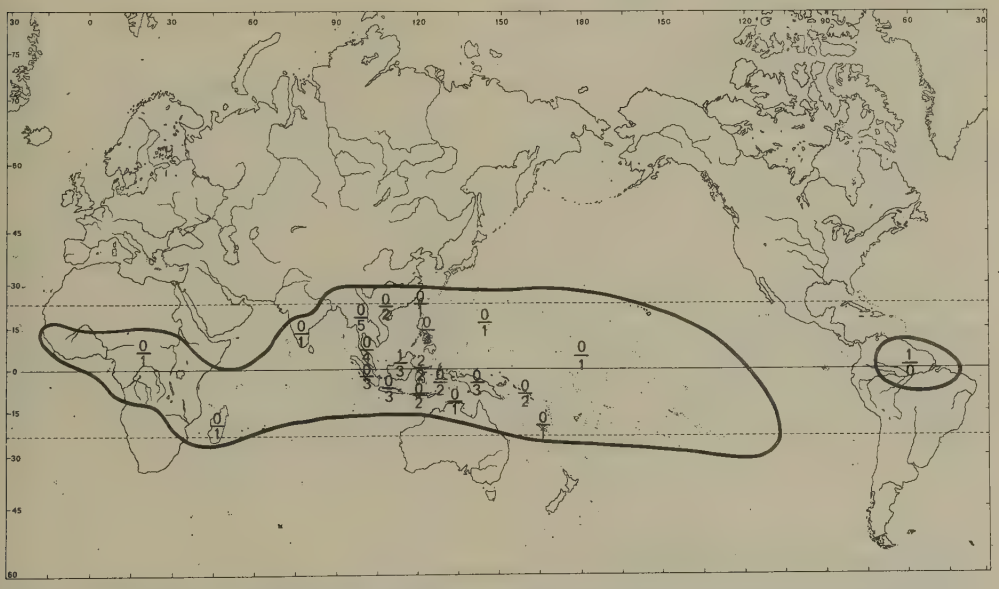

Fig. 1. Range of the genus *Tacca*; figures above the hyphen denote the number of endemic species, those below the hyphen the non-endemic species for each area or island group.

for the pollination units are built as traps—the helmet-like stamens, the obcordate lobes of the stigma—so that the insects cannot leave the flowers without efforts by which they effect pollination. It is not known whether the glandular cells secrete nectar in the flowers.

Besides these points, the filiform floral bracts and the large bracts around the inflorescence also may be attraction points for the insects.

Obviously, the flower biology of *Tacca* may yield interesting points and invites a critical study of observation and experiment yet to be made.

Dispersal. The ovoid or reniform, albuminous, ribbed or papillate seeds are smallish (*c.* 4–8 mm), with a fairly hard testa; they are freed in that the limping, decumbent, fruiting peduncle sags and deposits the fruit on the soil where it disintegrates; only in the continental SE. Asian species *T. plantaginea* the scape remains obvious erect and seeds are shed from a capsular fruit. How these seeds are dispersed over larger distances is unknown, but the more or less fleshy fruits will probably be eaten by ground animals; the raphe of the seed is distinct and fleshy. Some seeds must lead to new specimens at close range as *Taccas* are mostly found in groups of specimens.

In *T. leontopetaloides* the tuber emits from the growth apex thickish runners which grow downward and form a new tuber at apex, replacing the original tuber.

Seedlings. In the entire-leaved species young leaves are not different in shape from the mature ones. In *T. leontopetaloides* the first leaves are palmately incised, alike those of *T. palmatifida*; only later the mature leaves gain the 3-lobed pinnatifid structure.

It is observed that *T. leontopetaloides* may set flower after three years from seeding.

After flowering for the first time *Tacca* plants gain in dimension and differences in size have hence no systematical value.

In *T. leontopetaloides* leaves die off between December and March.

Morphology. The starchy, roundish or elongate, tuberous rhizomes are all naked and cauligenous. There are three types, *viz* a vertical elongate rhizome with apical growth in *T. integrifolia*, *T. plantaginea* (continental SE. Asia), and *T. chantrieri* (in *T. bibracteata* still unknown), a roundish rhizome with an apical cavity in *T. leontopetaloides*, *T. palmata*, and *T. ebeltajae*, and a horizontal elongate rhizome from the upper part of which leaves and inflorescences are emitted in a spaced way, hence without apical growth, in *T. palmatifida*, *T. celebica*, and *T. parkeri* (South America).

The erect peduncle (scape) terminates in an involucrum consisting of leafy, herbaceous, mostly erect bracts, between which the umbellately arranged flowers are situated. EICHLER's assumption that the flowers are placed in cincinni must be checked anatomically. Except in the palmately-leaved species and in *T. parkeri* long, filiform, drooping bracts are found between the flowers.

The epitepalous stamens have a characteristic structure: the short flattened filaments are adnate to the perianth tube except for the inflexed margins and a short free apical part which is like a helmet at the inside of which the anther cells are placed.

At the base of the style an annular zone or disk is sometimes present; in this zone glandular cells are present together with short or long emergences. Only in *T. leontopetaloides* the disk is clearly developed and provided with glandular hairs.

Phytochemistry. Starch is (or was) produced from the tuberous rhizomes of several species of *Tacca*. The underground parts are reported to be bitter and toxic; special treatments are used to make edible the starch or whole tubers. Unfortunately the chemical nature of the constituents of *Taccaceae* is still completely unknown. Alkaloids are said to be present in *T. integrifolia* KER-GAWL. (syn. *T. cristata* JACK) and *T. leontopetaloides* (L.) O.K. The tubers of the latter species were investigated by J. SCHEUER *et al.* (Lloydia 26, 1963, 133). Besides ubiquitous substances like sucrose, β-sitosterol and cerylic alcohol, a bitter principle and a yellow ester were isolated by these authors. Preliminary investigations of the bitter principle, named taccalin, indicate that it represents a rather unusual plant constituent. No structures of the systematically more relevant constituents of *Taccaceae* being known at present, chemotaxonomy cannot yet give any help to plant systematics in this instance.—R. HEGNAUER.

Taxonomy. PAX (1887) and LIMPRICHT (1928) subdivided the genus into two and three sections respectively, mainly based on the degree of dissection of the leaves and presence *cq.* absence of the filiform bracts. These sections are in my opinion unsatisfactory from the affinity point of view; there are four or five groups of species, three of which monospecific, and I find it undesirable to give these formal sectional rank. The only New World species, *T. parkeri* SEEM., occupies a rather isolated position, in that it does not fit into any of the Old World groups but shares certain characteristic characters with all of them.

Uses. The only species that is a useful plant for its edible tubers is *T. leontopetaloides*; see there.

KEY TO THE SPECIES

1. Leaves entire, elliptic, oblong to lanceolate.
2. Involucral bracts 2 . . . . . **4. T. bibracteata**
2. Involucral bracts 4.
3. Seeds ovate to ovate-oblong in outline, convex-concave, dorsoventrally flattened, more or less shell-

shaped. Fig. 5a–b. Involucral bracts not decussate, 2 outer ones opposite, 2 inner ones more or less in the axils of one of the outer ones . . . . . **2. T. integrifolia**

3. Seeds reniform, laterally flattened. Fig. 5c–d. Involucral bracts more or less decussate. **3. T. chantrieri**

1. Leaves distinctly shallowly or deeply lobed.

4. Leaves palmately divided into 3 lobes, each lobe pinnately divided into numerous smaller ones. Filiform bracts present . . . . . **1. T. leontopetaloides**

4. Leaves palmately incised and/or divided into 3–13 lobes, each lobe simple or only palmately divided into few ± similar lobes. Filiform bracts absent.

5. Leaves and inflorescence(s) crowded in a hollowed portion of a tuberous, roundish rhizome. Flowers inserted on the end of the scape between the bracts.

6. Outer involucral bracts oblong-ovate, 1–2.5 by 0.4–1 cm, inner ones cordate, 3–4.5 by 1.5–2 cm. Inner perianth lobes obovate, 5–6 by 3–4 mm, with rounded apex. Fruit obpyramidal, 1.3–1.5 by 0.8–1.2 cm . . . . . **6. T. ebeltajae**

6. Outer involucral bracts broadly-ovate to ovate, 2.5–9.5 by 2–9 cm, inner ones broadly-ovate to cordate, 4.5–10 by 2.5–6 cm. Inner perianth lobes constricted halfway, 3–5 by 2–4 mm, the apex acuminate. Fruit globose, up to 1 cm in ⌀ . . . . . **5. T. palmata**

5. Leaves and inflorescence(s) all spaced on an elongated, horizontal, cylindrical, tuberous rhizome. Flowers inserted on the basal portion of the inner two bracts.

7. Leaves simple, palmately incised for almost $^1/_3$ of their length. Fruit ellipsoid to obovoid, 2.2–3 by 1 by 1 cm. . . . . **7. T. palmatifida**

7. Leaves palmately compound, with 5 stalked leaflets of which the outer 2 may be connected at the base. Fruit obpyramidal, 1.8 by 1 by 0.8 cm . . . . . **8. T. celebica**

1. Tacca leontopetaloides (L.) O.K. Rev. Gen. Pl. 2 (1891) 704; BAILL. Hist. Pl. 13 (1894) 165, f. 107–110; BACK. Handb. Fl. Java 3 (1924) 107; HEYNE, Nutt. Pl. (1927) 452; LAM, Nieuw Guinee 1 (1935) 189, f. 37; MERR. J. Arn. Arb. 26 (1945) 85–92, pl. 1–2; HAYWARD, Baileya 5 (1957) 85; MANSFELD, Die Kult. Pfl. Beih. 2 (1959) 568; PARHAM, Pl. Fiji Is. (1964) 283; BACK. & BAKH. *f.* Fl. Java 3 (1968) 212; DRENTH, Blumea 20 (1972) 375, pl. 1, f. 1–7, with full synonymy and references. — *T. sativa* RUMPH. Herb. Amb. 5 (1747) 324, t. 112, *p.p.*, is partly *Amorphophallus*. — *T. phallifera* RUMPH. *l.c.* 326, t. 113, *p.p.*, is partly *Amorphophallus*. — *T. littorea* RUMPH. *l.c.* 328, t. 114. — *Leontice leontopetaloides* L. Sp. Pl. 1 (1753) 313; BURM. *f.* Fl. Ind. (1768) 82. — *T. pinnatifida* J. R. & G. FORST. Char. Gen. Pl. (1775) 35, t. 35; ROXB. Fl. Ind. ed. Carey 2 (1832) 172; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 368; GRIFF. Ic. Pl. As. 3 (1851) t. 272a, 1, 2; FILET, Pl. Bot. Tuin Weltevr. (1855) 13; MIQ. Fl. Ind. Bat. 3 (1859) 577; BENTH. Fl. Austr. 6 (1873) 458, *cum var.*; BAKER *f.* Fl. Maur. (1877) 370; HOOK. *f.* Fl. Br. Ind. 6 (1892) 287; Bot. Mag. III, 49 (1893) t. 7299, 7300; KAERNB. Bot. Jahrb. 16 (1893) Beibl. *n.* 37, 13; BAKER *f.* Fl. Trop. Afr. 7 (1898) 413; BAILEY, Queensl. Fl. 5 (1898) 1613; TRIM. Fl. Ceyl. 4 (1898) 273; LIMPR. Inaug. Diss. Breslau (1902) 50, *incl. ssp. involucrata* LIMPR. *etc.*; RIDL. Mat. Fl. Mal. Pen. 2 (1907) 76; MERR. Fl. Manila (1912) 150; BAILEY, Compr. Cat. Queensl. Pl. (1913) 548, t. 533, *incl. var. brownii* (SEEM.) BAILEY, *l.c.* t. 534; MERR. Int. Rumph. (1917) 144; RIDL. Fl. Mal. Pen. 4 (1924) 309; LIMPR. Pfl. R. Heft 92 (1928) 27; GAGNEP. Fl. Gén. I.-C. 6 (1934) 697; BURK. Dict. (1935) 2118; PERRIER DE LA BATHIE, Fl. Madag. fam. 43 (1950) with plate; QUIS. Medic. Pl. Philip. (1951) 177. — *T. pinnatifolia* GAERTN. Fruct. (1788) 43, t. 14. — *T. involucrata* (LIMPR.) SCHUM. & THONN. Beskr. Guin. Pl. (1827) 197; DARLINGTON & WYLIE, Chrom. Atlas ed. 2 (1955) 403. — *T. dubia* SCHULT. Syst. Veg. 7 (1829) 167. — *T. gaogao* BLANCO, Fl. Filip. (1837) 262. — [*T. maculata* ZIPP. *ex* SPAN. Linnaea 15 (1841) 480, *nom. nud.*] — *T. brownii* SEEM. Fl. Vit. (1866) 100; LIMPR. Pfl. R. Heft 92 (1928) 30. — *T. artocarpifolia* SEEM. Fl. Vit. (1866) 101. — *T. maculata* SEEM. *l.c.* 103. — *T. samoensis* REINECKE, Bot. Jahrb. 25 (1898) 595, t. 9. — *T. viridis* HEMSL. in Hook. Ic. Pl. IV, 6 (1899) t. 2515, 2516; LIMPR. Inaug. Diss. Breslau (1902) 50; RIDL. Mat. Fl. Mal. Pen. 2 (1907) 78; LIMPR. Pfl. R. Heft 92 (1928) 26; GAGNEP. Fl. Gén. I.-C. 6 (1934) 697. — *T. hawaiiensis* LIMPR. Pfl. R. Heft 92 (1928) 30.

Tuber depressed-globose or broadly ellipsoid, thin-skinned, smooth, 1.5–5 cm high by 1–8 by 0.5–4 cm, white when young, older dark grey to brown, white within, somewhat juicy, growing near the surface to up to 50 cm deep, provided with an apical cavity emitting the leaves and inflorescences; the tuber is replaced during the year by a new main tuber which arises from a downward-growing runner-like thick rhizome at a lower level and remains dormant after yearly death of aerial parts of the original plant. Base of the leaves and the inflorescence in young plants (mostly?) surrounded by a linear-lanceolate, special leaf (cataphyll) 8–21 by 1.2–3 cm. *Leaves* 1–3, broadly obovate, ovate, or oblong-ovate in outline, palmately 3-sect, each of the 3 segments pinnately lobed to dissected, up to 70 by 120 cm; lobes orbicular to linear; petiole hollow, 17–150 by 0.3–2.5 cm, sheath 2–25 by 0.6–3.5 cm. *Inflorescences* 1 or 2, 20–40-flowered; scape hollow, green, 20–170 by 0.2–2.5 cm. *Involucral bracts* of different size, large ones 4–9 (–12), mostly surrounding the scape, sometimes only on the ribbed side of the scape (in that case with up to 10 small bracts in the

canaliculate zone), light to dark green, sometimes with fine purplish margin, 2 (–4) outer ones sessile, (ob)ovate, oblong, or lanceolate, 2.5–10 by 1.2–3.5 cm, with attenuate or cuneate base, acuminate at the apex, acumen entire or 2–3 dentate; 2–7 (–10) inner bracts more or less similar in shape to the outer ones, acuminate at the apex, curvinerved with pinnate side nerves, 2.5–10 by 0.7–5 cm; the small bracts linear lanceolate, sessile, with acute apex, 5–7 by 1–1.5 mm. *Filiform bracts* 20–40, up to 25 cm, (dark) purple or dark blackish-brown. *Flowers* 6–17 by 6–13 mm, drooping, light yellow, yellowish green or blackish purplish green; pedicel up to 6 cm by 1 mm (in fruit up to 8 cm by 2 mm); perianth tube 1.5–5 by 4–11 mm. *Perianth lobes* mostly fleshy with membranous margins, persistent, 3 outer ones elliptic or ovate (lanceolate), (1.5–) 4–7 by 2–3 mm, 3 inner ones (broadly) ovate or oblong ovate, 5–7.5 by 2.5–5 mm; apices obtuse or retuse, rarely truncate. *Stamens* white or dull yellow to brown or purple; adnate portion of the filaments 1–5 by 2–2.5 mm, free apical portion 1.5–2 by 1.5–2 mm, thecae up to 2 mm long. *Ovary* 2–5 by 2–4 mm; disk annular, ribbed, (always?) with numerous pellucid glandular hairs, 1.5–3 mm ⌀; style 1.5–3 by 0.5–1.5 mm, whitish to green; stigmatic lobes whitish to purple, 1.5–2 by 2–3 mm, sometimes their 2 apices emarginate. *Fruit* mostly globose, 1.5–2.5 cm ⌀, but sometimes ellipsoid or ovoid, up to 3.5 by 1.5–2.5 cm, pendulous, pale to darker green, finally pale orange; pericarp up to 1.5 mm thick. *Seeds* many, ovoid to ellipsoid, flattened, 5–8 by 3–5 by 1.5–3 mm glabrous, yellowish brown, with a spongy white testa, 15–19-ribbed.

Distr. Widely distributed in the Old and New World from W. Africa through SE. Asia, throughout *Malesia*, N. Australia to Polynesia (as far as the Tuamotus, Marquesas, and Hawaii). Fig. 2.

Ecol. Very indifferent to climatic, soil, and vegetation conditions, more rarely in heavy shade and in primary forest, frequently in coastal vegetation, usually below 200 m, occasionally up to 1100 m, the superterranean parts mostly dying off between December and March. *Fl. fr.* Jan.–Dec.

Seeds might be dispersable by seawater, and might possess buoyancy by their spongy testa. It is said also that some birds eat the fruit (RIDL. Disp. 1930, 470). Dispersal by man, however, is the most effective agency, as the plant has been and still is generally used for food.

Uses. Starch is extracted for making bread, paste, and puddings mixed with other ingredients. Good washing is essential because of the presence of the bitter substance (taccalin) which is said to be poisonous. Tubers are dug when the aerial parts have died off. In India and Polynesia tubers are also used as a medicine against diarrhoea. In Polynesia the fibres of the peduncle are used for making hats and for fishing. Especially in the

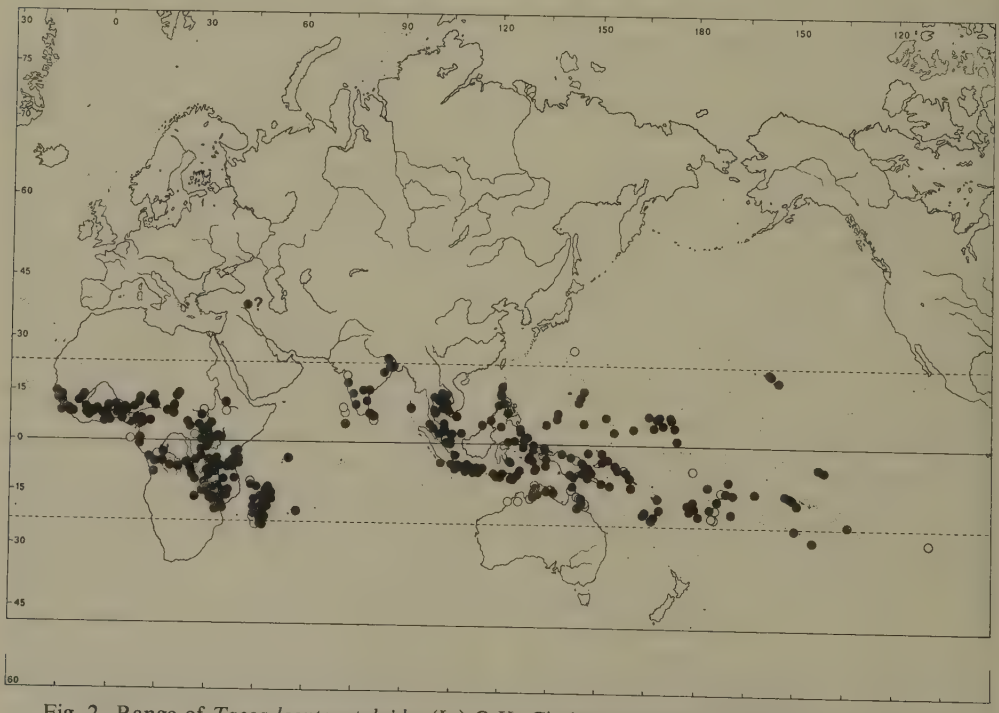

Fig. 2. Range of *Tacca leontopetaloides* (L.) O.K. Circles are localities derived from literature.

Pacific islands the plant has been cultivated on an extensive scale (see HEYNE, 1927). In cultivated plants the tuber is 5–10 cm long, but whether it may reach the size of a coconut, as is sometimes cited in literature, is doubtful to me.

Vern. Malaya: *(poko) lukeh*, (? *lěkek*). Sumatra: *lěki*, Atjeh, *lago leké*, Riau, *krubut*, Enggano. Java: *katjondang*, *tjondang*, S, *katjunda*, *taka laut*, M, *labing*,Md, *kětjondang*, *tjondang*, J, *totoan*, Kangean. Timor: *tělo*, *tiloh*. Celebes: *kalopale*, Buton, *katjodo*, *katjunda*, Makassar, Saleyer, *katéo*, E. Cel., *tèrong i lawanan*, Alf., t.t., Minah. Philippines: *gau-gáu*, *yabyában*, Tag., *kanóbong*, *tayóbong*, Bis., *panarién*, Ilk., *tambóbon*, Sbl. Moluccas: *lěkěr*, *likir*, M, *anuwal*, Taruna, *huda korano*, *huda ma raka*, *nepu*, Ternate, *taä*, Buru. New Guinea: *tavulipum*, Tami.

Notes. In the vegetative state the plant is sometimes confused with equally tuberous species of the Araceous *Amorphophallus*, but it can immediately be recognized by the ribbed, hollow petiole, which is in *Amorphophallus* solid, smooth, and mostly flecked. As a matter of fact it was RUMPHIUS, from whom the name *Tacca* stems, who made this confusion, as MERRILL has revealed in his Interpretation of Rumphian plants (1917).

The species has a formidable synonymy as local forms have been described in many parts of its very large range. LIMPRICHT (1928) has distinguished some of them as subspecies or varieties and even seven forms he maintained as species. These forms and variations were largely based on leaf characters. In my opinion none of them deserves taxonomical distinction.

2. Tacca integrifolia KER-GAWL. Bot. Mag. 35 (1912) t. 1488; LAMK, Enc. Suppl. 5 (1817) 278; ROXB. Pl. Corom. 3 (1820) 53, t. 257; SPRENG. Syst. Veg. 2 (1825) 118; BL. En. Pl. Jav. 1 (1827) 83; PRESL, Rel. Haenk. 1, 3 (1828) 149; SCHNIZL. Icon. 1 (1843) 58; HOOK. *f.* Fl. Br. Ind. 6 (1892) 287; LIMPR. Inaug. Diss. Breslau (1902) 44; Pfl. R. Heft 92 (1928) 16, *incl. var. pseudolaevis* LIMPR. *l.c.* 17; MITRA, Fl. Pl. East. Ind. 1 (1958) 55; DRENTH, Blumea 20 (1972) 388, pl. 3, f. 19–21. — *T. cristata* JACK, Mal. Misc. 1, 5 (1821) 23; MIQ. Fl. Ind. Bat. 3 (1859) 578; HOOK. *f.* Fl. Br. Ind. 6 (1892) 287; BAILL. Hist. Pl. 13 (1895) 167, f. 111–113; LIMPR. Inaug. Diss. Breslau (1902) 44; RIDL. Mat. Fl. Mal. Pen. 2 (1907) 77; J. Str. Br. R. As. Soc. 49 (1907) 45; Fl. Mal. Pen. 4 (1924) 310; LIMPR. Pfl. R. Heft 92 (1928) 20; MERR. Pl. Elm. Born. (1929) 28; BURK. Dict. (1935) 2118; MERR. J. Arn. Arb. 33 (1952) 247; HEND. Mal. Wild Fl. (1954) 187. — *Ataccia integrifolia* PRESL, Rel. Haenk. 1, 3 (1828) 149; MIQ. Fl. Ind. Bat. 3 (1859) 578. — [*T. rafflesiana* JACK *ex* WALL. Cat. (1831–32) 5172A, B, *nom. nud.*] — *T. aspera* ROXB. Fl. Ind. ed. Carey 2 (1832) 169; LIMPR. Pfl. R. Heft 92 (1928) 20. — *T. laevis* ROXB. Fl. Ind. ed. Carey 2 (1832) 171; GRAHAM, Cat. Bomb. (1839) 730; HOOK. *f.* Fl. Br. Ind. 6 (1892) 288; HALLIER, Bull. Herb. Boiss. 6 (1898) 613; LIMPR. Inaug. Diss. Breslau (1902) 47; RIDL. J. Str. Br. R. As. Soc. 49 (1907) 45, *incl. var. minor* RIDL., *p.p. typ. excl.*; LIMPR. Pfl. R. Heft 92 (1928) 17, *incl. var. latibracteata* LIMPR. *l.c. et var. angustibracteata* LIMPR. *l.c.* 18; GAGNEP. Fl. Gén. I.-C. 6 (1934) 695; MITRA, Fl. Pl. East. Ind. 1 (1958) 55; SMITINAND, Nat. Hist. Bull. Siam Soc. 20 (1961) 60. — *T. lancaefolia* ZOLL. & MOR. in Mor. Syst. Verz. (1846) 91; MIQ. Fl. Ind. Bat. 3 (1859) 578; LIMPR. Inaug. Diss. Breslau (1902) 48; BEUMÉE, Trop. Natuur 8 (1919) 47, f. 7; BACK. Handb. Fl. Java 3 (1924) 106; LIMPR. Pfl. R. Heft 92 (1928) 19, *incl. var. laeviformis* LIMPR.; BACK. & BAKH. *f.* Fl. Java 3 (1968) 212. — *Ataccia aspera* KUNTH, Enum. 5 (1850) 464. — *Ataccia laevis* KUNTH, *l.c.* 466. — *Ataccia lancaefolia* KUNTH, *l.c.* 465; ZOLL. Syst. Verz. 1 (1854) 69 (as *Atacca*). — *Ataccia cristata* KUNTH, Enum. 5 (1850) 466; Bot. Mag. 57 (1851) t. 4589; LEMAIRE, Jard. Fleur. 2 (1852) t. 186, 187; KUNTH, Fl. Serres I, 9 (1853) t. 860–861; OUDEMANS, Neerl. Pl. Tuin 2 (1866) t. 32; LE MAOUT & DECNE, Traité Gén. Bot. (1868) 573; Garden 5 (1874) 219; Gartenflora 30 (1881) 346. — *T. borneensis* RIDL. J. Str. Br. R. As. Soc. 49 (1907) 45; LIMPR. Pfl. R. Heft 92 (1928) 21. — *T. chantrieri* (*non* ANDRÉ) RIDL. Fl. Mal. Pen. 4 (1924) 309. — *T. sumatrana* LIMPR. Pfl. R. Heft 92 (1928) 18, *incl. var. ovalifolia* LIMPR. *l.c.* 19 — *T. chaudhuriana* DEB, Ind. For. 90 (1964) 241, t. 1, 2. — **Fig. 5a–b.**

Rhizome cylindric, growing vertically, up to 12 cm long by up to 3 cm ∅. *Leaves* 2–13, rosulate, very variable, usually oblong(-ovate) or lanceolate, more rarely elliptic, oblong-obovate or linear-lanceolate, greyish green, 7.5–65 by 3–24 cm, base attenuate, rarely cuneate or rounded, apex acuminate; nerves pinnate; petiole 4.5–41 cm by 2–6 mm, sheath 2.5–17 by 0.5–1.5 cm. *Inflorescences* 1–4 (–5), up to 30-flowered; scape 9–65 (–100) cm by 2–7 mm, dark violet, blackish purple, red, or rarely brown. *Involucral bracts* 4, very variable, 2 outer bracts opposite, 2 inner ones inplanted together more or less in the axil of one of the outer bracts; outer ones sessile, elliptic, oblong, (narrowly) triangular, or (ovate) lanceolate, 1.5–14 by 0.5–7 cm, green to purple, veined black, apex acute, acuminate, rarely cuspidate; inner bracts thinner than the outer ones, sessile or with attenuate to cuneate base, (ob)ovate, oblong-(ob)ovate, (ob)-lanceolate, or spatulate, rarely orbicular, 2.5–22 by 1–11 cm, white, shaded purple, veined black, apex acuminate or cuspidate. *Filiform bracts* 5–27, up to 25 cm by 0.2–1 mm, white or bright yellow green, on base darker. *Flowers* 1.4–2.7 by 0.6–3.2 cm; buds pale greenish, flowers green, greenish-violet, brownish-purple, or blackish-violet, the colour becomes steadily darker; pedicel 0.5–4 cm by 1–2 mm, dark red or blackish-purple; perianth tube 3–8 by 9–15 mm. *Perianth lobes* mostly reflexed during anthesis and caducous; 3 outer ones elliptic, triangular or oblong, 6–15 (–20) by 4–9 mm, inner ones broadly obovate or broadly ovate, 5–15 by 5–16 mm; at apex emarginate, retuse, rounded, acute, acuminate, or mucronate. *Stamens*: adnate portion of the filaments 2–3 by 0.5–1 mm, free apical portion up to 3 by 1.5 mm, thecae up to

Fig. 3. *Tacca integrifolia* KER-GAWL. In damp forest among rocks, along Ketambe R. (tributary of Alas R.), *c.* 35 km NW. of Kotatjane, Gajolands, N. Sumatra. Peduncle and bracts are dirty black-purple (Photogr. DE WILDE & DE WILDE-DUYFJES, 14354, 18-8-1972).

2 mm long. *Ovary* 3–15 by 2–7 mm, yellowish green with sepia-purple ribs; disk absent; style 1–3 by 1–3 mm; stigma lobes 1 by 1.5 mm. *Fruit* triangular to circular in cross-section, 2.5–5 by 1–2.5 cm, green to black, tinged with purple, pericarp up to 2 mm thick. *Seeds* ovoid convex--concave, 3.5–6 by 1–3.5 by 1–2 mm, glabrous to strongly papillose, 6–16-ribbed.

Distr. Continental SE. Asia (Bhotan, Assam, Bangla Desh, Burma, Thailand), in *Malesia*: Sumatra (throughout, incl. Banka, Lingga), West Java, Borneo (incl. Nunukan and Anambas & Natuna Is.). Fig. 4.

Ecol. Most primary and secondary forests, on various soils, from sea-level up to 1200 (–1500) m. *Fl. fr.* Febr.-Aug.

Vern. Malaya: *bunganbatong*, *pako bunga subeak*, *pako iangot baoo*, *poko subiak*, *subiak*, Malacca, *jangut bawo*, *kĕladi murai*, *lĕbak tikus*, *sebiak*, Negri Sembilan, *kĕlĕmoyang ayĕr*, *yanggut baung*, *yanggut kĕli*. Sumatra: *puar lilipan*, *sa-lipit*, *si dalimbat*, Toba-Batak, Asahan, *djangat baung*, Indragiri, *daun patjam*, *pura gunung*, Djambi, *tambun tambun*, S. Sumatra, *gumba itam*, Banka. Java: *kumis utjing*, *tjurug lukur*. Borneo: *gĕdang gĕdang*.

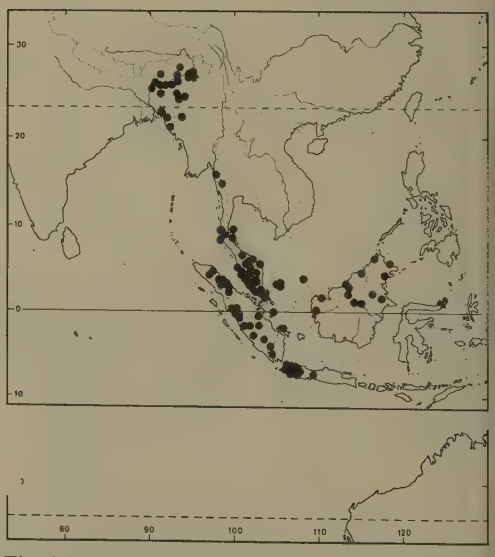

Fig. 4. Range of *Tacca integrifolia* KER-GAWL. (●) and *T. celebica* KOORD. (▲).

3. Tacca chantrieri ANDRÉ, Rev. Hort. 73 (1901) 541, with plate; LIMPR. Inaug. Diss. Breslau (1902) 45; *non* RIDL. Fl. Mal. Pen. 4 (1924) 309 (= *T. integrifolia*); LIMPR. Pfl. R. Heft 92 (1928) 14, *incl. f. garrettii* (CRAIB) LIMPR. *l.c.*, *f. macrantha* (LIMPR.) LIMPR. *l.c. et var. vespertilio* (RIDL.) LIMPR. *l.c.* 16; GAGNEP. Fl. Gén. I.-C. 6 (1934) 694; HAYWARD, Baileya 5, 2 (1957) 85; DRENTH, Blumea 20 (1972) 393, f. 1e, pl. 3, f. 22–24. — *T. macrantha* LIMPR. Inaug. Diss. Breslau (1902) 45; BACK. & BAKH. *f.* Fl. Java 3 (1968) 212. — *T. lancifolia var. breviscapa* OSTENFELD, Bot. Tidsskr. 26 (1904) 165. — *T. vespertilio* RIDL. J. Str. Br. R. As. Soc. 49 (1907) 46; Mat. Fl. Mal. Pen. 2 (1907) 77. — *T. minor* RIDL. Mat. Fl. Mal. Pen. 2 (1907) 78; Fl. Mal. Pen. 4 (1924) 311; LIMPR. Pfl. R. Heft 92 (1928) 18. — *T. garrettii* CRAIB, Kew Bull. (1912) 10, 406. — *Clerodendron* ('*Cherodendron*') *esquirolii* LÉVL.

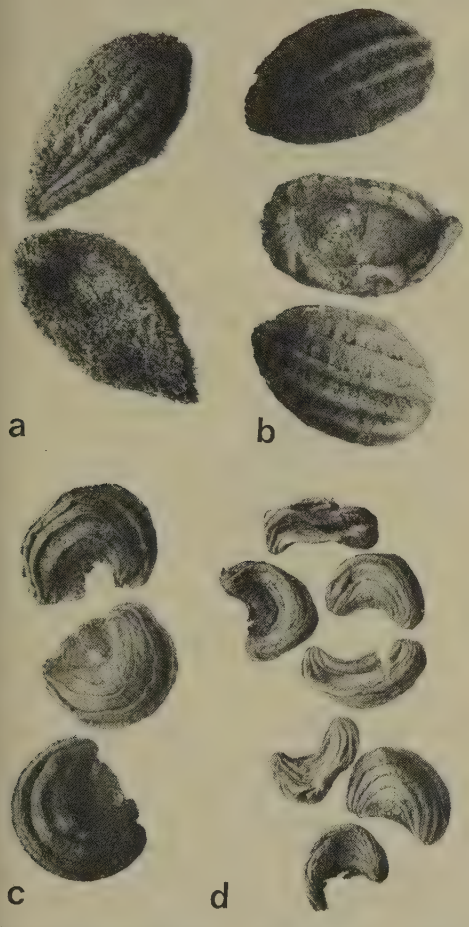

Fig. 5. *Tacca integrifolia* KER-GAWL. *a–b.* Seeds. — *T. chantrieri* ANDRÉ. *c–d.* Seeds. All × 5 (*a* BACKER 23920, *b* AWANG YACUB 6546, *c* RIDLEY *s.n.*, SING sheet 41640, *d* J. SCHMIDT 641).

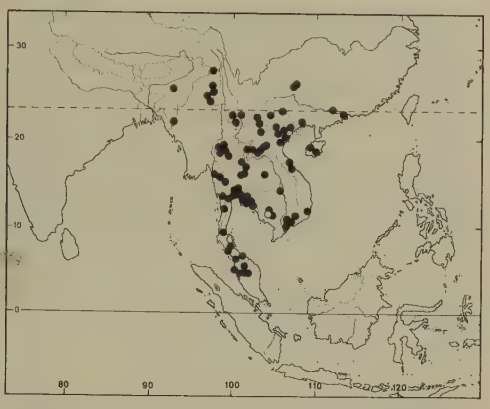

Fig. 6. Range of *Tacca chantrieri* ANDRÉ. The two circles are localities derived from literature.

Fedde Rep. 11 (1912) 298; *cf.* P'EI, Mem. Sc. Soc. China 1, 3 (1932) 162. — *T. cristata* (*non* JACK) VELENOVSKY, Vergl. Morph. Pfl. 4, Suppl. (1913) 52, f. 19. — *Schizocapsa breviscapa* LIMPR. Pfl. R. Heft 92 (1928) 11; GAGNEP. Fl. Gén. I.-C. 6 (1934) 693. — *T. paxiana* LIMPR. Pfl. R. Heft 92 (1928) 16; GAGNEP. Fl. Gén. I.-C. 6 (1934) 694. — *T. roxburghii* LIMPR. Pfl. R. Heft 92 (1928) 18; SMITINAND, Nat. Hist. Bull. Siam Soc. 20 (1961) 61. — *T. wilsonii* LIMPR. Fedde Rep. 38 (1935) 218. — *T. esquirolii* (LÉVL.) REHDER, J. Arn. Arb. 17 (1936) 64; METCALF, J. Arn. Arb. 26 (1945) 198. — **Fig. 5c–d, 7e.**

Rhizome cylindric, growing vertically, up to 10 cm long by 1.5 cm ∅. *Leaves* 3–12, rosulate, variable, elliptic, ovate, oblong-(ob)ovate, or (ovate-)lanceolate, 17–55 by 4.4–22 cm, deep green, paler beneath, base cuneately attenuate but not decurrent, sometimes unequal, apex acuminate; nerves pinnate; petiole 11–43 cm by 2–5 mm, sheath 3–15 by 0.3–2 cm. *Inflorescences* 1–2, up to 25-flowered; scape 6–63 by 0.1–0.7 cm. *Involucral* bracts 4, (sub)decussate, variable, green to almost black; 2 outer bracts ovate or triangular to ovate--lanceolate, sessile, 2–9 by 0.8–4 cm, apex acute or acuminate, 2 inner bracts thinner, (broadly) ovate to oblong, sometimes unaequilateral, 2.5–10 by 1.5–9 cm, sessile or with attenuate base, apex acute or acuminate. *Filiform bracts* 6–26, up to 20 cm by 0.2–1 mm, pale green or violet green. *Flowers* 1–2.5 by 0.6–2 cm, buds green, flowers greenish white when young, when older red, violet, purple, or blackish; pedicel 1.2–4 cm by 0.5–2 mm ∅; perianth tube 3–7 by 6–15 mm. *Perianth lobes* mostly reflexed during anthesis and persistent as a small remnant; 3 outer ones (oblong-)ovate or (narrowly) triangular, 5–12 by 3–8 mm, apex acute, acuminate, or mucronate; 3 inner ones (broadly) ovate, or triangular, 4–11 by 4–12 mm; apex acuminate or mucronate, veins prominent at inside. *Stamens*: adnate portion of the filaments 2–3 by 0.5–1 mm, free apical portion 3 by 1.5 mm; thecae up to 2 mm long, greenish yellow. *Ovary*

2–7 by 3–5 mm; disk absent; style 2–3 by 2–3 mm; stigmatic lobes 1 by 1.5 mm. *Fruit* triangular to round on cross-section, 2–4 by 1–2 cm, (lustrous) green, deep orange-red, or purple. *Seeds* reniform, 3–4 by 2–3 by 1–1.5 mm, glabrous, brown, 9–14-ribbed.

Distr. Continental SE. Asia: Assam, Bangla Desh, Burma, Thailand, China (Yunnan, Kweichow, Kwangsi, Kwantung, Hainan), Indo-China, in *Malesia*: Malay Peninsula (Perlis, Penang, Perak). Fig. 6.

Ecol. Primary and secondary forests, in Malaya at low altitude and on hills, elsewhere ascending to 1400 (–2100) m. *Fl. fr.* Febr.-Oct.

Uses. Tender leaves and inflorescences eaten in curries; in Thailand the bitter rhizome is used for medicinal purpose.

Note. From *T. integrifolia* distinguished by the nearly always decussate involucral bracts and the reniform seeds.

4. Tacca bibracteata DRENTH, Blumea 20 (1972) 395, f. 1a–c. — **Fig. 7a–c.**

Rhizome unknown. *Leaves* 6 or 7, oblong, 25–27 by 9.5–10.5 cm, with attenuate base and acuminate apex; nerves pinnate; petiole 12–19 by 0.2 cm, sheath 3.5–5.5 by 0.8–1.2 cm. *Inflorescence* as far as known solitary, up to 10-flowered; scape 20–31 by 0.2–0.5 cm, tinged with violet. *Involucral bracts* 2, opposite, ovate, 2–2.8 by 1.3–2.2 cm, sessile, apex acuminate. *Filiform bracts* 12–15, up to 10 (–14) cm by 0.4 (–2) mm ∅ (see note). *Flowers* 1–2 by 0.8–1.6 cm, green, tinged violet or very dark purple; pedicel 1–3.5 cm by 1–1.5 mm ∅; perianth tube 2–5 by 4–12 mm. *Perianth lobes*: 3 outer ones (broadly) ovate, 7–12 by 5–14 mm, with a long acuminate apex; 3 inner ones transversally broad-elliptic, 4–6 by 5–8 mm, with a mucronate or acuminate apex. *Stamens*: adnate portion of filaments 2 by 4 mm, free apical portion 2 by 2 mm; thecae up to 2 mm long. *Ovary* 7 by 7 mm; disk absent; style 2 by 3 mm; stigma lobes 1 by 2 mm. *Fruit* (unripe) obpyramidal, 1.5 by 0.8 by 0.8 cm. *Mature seeds* unknown.

Distr. *Malesia*: Borneo (Sarawak), 3 collections. Fig. 9.

Ecol. Mixed lowland Dipterocarp forest and in secondary forest, below 300 m.

Note. The measurements of the filiform bracts given in brackets were taken from 2 bracts which as an exception are neither ribbed, nor round, but flattened, and are facing each other and alternating with the involucral bracts. In my opinion they are actually involucral bracts, but for convenience sake I have called them filiform bracts.

5. Tacca palmata BL. En. Pl. Jav. 1 (1827) 83; SCHAUER, Nov. Act. Nat. Cur. 19 (1843) Suppl. 1, 444; ZOLL. Syst. Verz. 1 (1854) 69; MIQ. Fl. Ind. Bat. 3 (1859) 577; LIMPR. Inaug. Diss. Breslau (1902) 49; RIDL. Mat. Fl. Mal. Pen. 2 (1907) 76; MERR. Fl. Manila (1912) 150; Int. Rumph. (1917) 145; Sp. Blanc. (1918) 100; BEUMÉE, Trop. Natuur 8 (1919) 48; M.E.J. Trop. Natuur 9 (1920) 70, f. 1; BACK. Handb. Fl. Java 3 (1924) 107; RIDL. Fl. Mal. Pen. 4 (1924) 309; MERR. Philip. J. Sc. 29 (1926) 357; HEYNE, Nutt. Pl. (1927) 454; BACK. Onkr. Suiker. 1 (1928) 190; LIMPR. Pfl. R. Heft 92 (1928) 24, *incl. var. borneensis* LIMPR. *l.c.* 25; GAGNEP. Fl. Gén. I.-C. 6 (1934) 696; HOLTHUIS & LAM, Blumea 5 (1942) 168; STEEN. Fl. Scholen Indon. (1949) 144; QUIS. Medic. Pl. Philip. (1951) 177; SMITINAND, Nat. Hist. Bull. Siam Soc. 20 (1961) 61; BACK. & BAKH. *f.* Fl. Java 3 (1968) 212; DRENTH, Blumea 20 (1972) 397, pl. 2, f. 10–15. — *Pentaphyllum indicum* CLUSIUS, Exoticorum 4 (1605) 89 & fig. — *T. montana* RUMPH. [Herb. Amb. 5 (1747) 329, t. 115] *ex* SCHULTES, Syst. Veg. 7, 1 (1829) 168; HASSK. Cat. Hort. Bog. 2 (1844) 34. — *T. integrifolia* (*non* KER-GAWL.) SCHRANK, Syll. Pl. Ratisb. 1 (1824) 203. — *T. vesicaria* BLANCO, Fl. Filip. (1837) 261. — *T. rumphii* SCHAUER, Nov. Act. Nat. Cur. 19 (1843) Suppl. 1, 442; MIQ. Fl. Ind. Bat. 3 (1859) 577; SCHEFFER, Nat. Tijd. N. I. 31 (1870) 375; LIMPR. Inaug. Diss. Breslau (1902) 49; ELMER, Leafl. Philip. Bot. 6 (1914) 2284; MERR. Sp. Blanc. (1918) 100; LIMPR. Pfl. R. Heft 92 (1928) 24; HOSOKAWA, J. Jap. Bot. 13 (1937) 197. — *T. elmeri* KRAUSE, Leafl. Philip. Bot. 6 (1914) 2283; LIMPR. Pfl. R. Heft 92 (1928) 25; ELMER, Leafl. Philip. Bot. 10 (1939) 3795. — *T. angustilobata* MERR. Philip. J. Sc. 29 (1926) 356. — *T. fatsiifolia* WARB. *ex* LIMPR. Pfl. R. Heft 92 (1928) 23. — *T. weberi* ELMER, Leafl. Philip. Bot. 10 (1939) 3794, *nom. inval.*

Tuber globose to broadly ellipsoid, 1–2.5 cm high by 1.5–5 (–8 cm, once observed) by 1.3–3 cm, fleshy, sordidly light brown with an apical cavity from which the leaves and inflorescences emerge. *Leaves* 1–3 (–5), broadly reniform or semi-orbicular in outline, 3–13, usually 4–8-palmatipartite, 7–36 by 7.5–40 cm; base attenuate; lobes (narrowly) obovate, elliptic, or (linear) lanceolate, 6–25 by (0.5–) 1–10 cm, with attenuate base and acuminate apex, the outer lobes mostly smaller than the inner ones; petiole (12–) 15–60 (–75) by 0.1–0.4 cm, sheath 2.5–7.5 by 0.3–0.8 cm. *Inflorescences* 1 or 2 (or 3), up to 30-flowered; scape 20–80 by 0.2–0.5 cm. *Involucral bracts* 4, decussate, green tinged with violet; 2 outer ones (broadly) ovate, 2.5–9.5 by 2–9 cm, sessile, apex acuminate; inner ones broadly ovate or cordate, 4.5–10 by 2.5–6 cm, with inflexed margins in the basal part, base attenuate, apex acuminate, sometimes caudate. *Flowers* 6–17 by 5–10 mm, green, tinged violet brown, brown violet, or dark violet; pedicel 10–20 by 0.5–1 mm; perianth tube 2–5 by 4–8 mm. *Perianth lobes*: 3 outer ones (broadly) ovate, rarely elliptic, 2–6 by 2.5–6 mm, obtuse or rounded at the apex; 3 inner ones with an acuminate apex, 3–5 by 2–4 mm, inflexed, each composed of a triangular basal portion of 0.5–1.5 by (2–) 3–4 mm, connected by a narrower part of 1–2 by 1–2 mm to a (sub)circular apical portion of 1.5–2.5 by 2–3 mm, the side lobes of which are reflexed. *Stamens*: adnate portion of the filaments up to 2.5 by 3 mm, free apical portion up to 2 by 2 mm; thecae up to 2 mm long. *Ovary* 2–5 by 1–4 mm;

Fig. 7. *Tacca bibracteata* DRENTH. *a*. Habit, × 1/2, *b*. fruit, *c*. flower, both × 1 1/2. — *T. plantaginea* (HANCE) DRENTH. *d*. Leaf-base, × 1/2. — *T. chantrieri* ANDRÉ. *e*. Leaf-base, × 1/2 (*a*, *c* ASHTON S 18369, *b* RICHARDS 1569, *d* KERR 8891, *e* KOSTERMANS 1148).

disk absent; style 2 by 2 mm; stigma lobes 1.5–2 by 2 mm. *Fruit* globose, up to 1 cm ∅, mostly with 3 distinct and 3 indistinct ribs, bright red, pericarp up to 1 mm thick. *Seeds* up to 11 in each fruit, more or less pyramidal with a rounded base, 3–5 by 2–4 by 2–3 mm, 15–20-ribbed.

Distr. Continental SE. Asia (Indo-China, Thailand), in *Malesia*: Malay Peninsula (Kelantan, Johore, Penang, P. Tioman), Sumatra (throughout, incl. Enggano, Krakatao, Banka, Lingga), throughout Java (incl. Madura, Kangean, Bawean, Karimondjawa), Lesser Sunda Is. (Sumba, Flores, Timor), Borneo (incl. Tambelan Is., Karimata, Anambas & Natuna Is., Banguey), Philippines (Balabac, Palawan, Calamianes, Mindoro, Luzon, Leyte, Panay, Mindanao, Sulu), Celebes (incl. Saleyer, Muna, Buton), Moluccas (Talaud, Halmaheira, Ceram, Ambon, Saparua, Key, Tenimber Is.), West New Guinea (only Misool I.). Fig. 8.

Ecol. Mostly in secondary vegetation and forest margins, also in teak forest and bamboo groves, indifferent to soil and climate, from sea-level up to *c.* 1000 m. *Fl. fr.* Nov.-July.

Uses. In Malesia in different places used as a drug, generally in the form of scrapings of the tuberous rhizome, which are of a bitter taste. These scrapings are laid on wounds, *e.g.* caused by snake bites. Crushed petioles and scrapings are

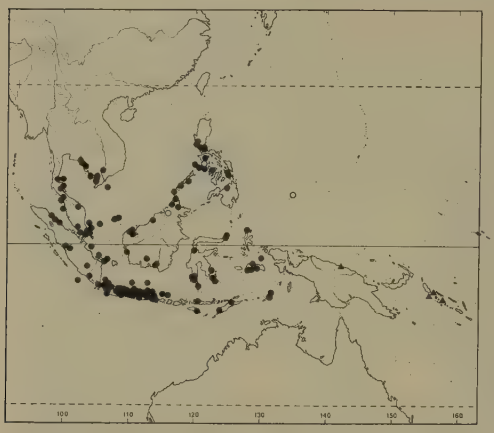

Fig. 8. Range of *Tacca palmata* BL. (• specimens studied, ○ from literature) and *T. ebeltajae* DRENTH (▲).

laid on the stomach to prevent aches. In the Philippines the drug is also taken by women against menstrual disorders.

Vern. Sumatra: *atjang tjangang*, Krakatao, *gadung tĕkus*, *tumbal*, Banka. Java: *djambean*, Bawean I., *gadung tikus*, M. *ilĕs-ilĕs*, *kĕmĕndulan kĕmú dulan*, *tĕnggiling mĕntik*, *tjèkèr ajam*, *trĕnggiling mĕntik*, *tringgiling mèntèk*, J, *kotok bongkok*, *kumis utjing*, *obat tjekok kuda*, S, *pakis uling*, Djember, *suveg lĕtik*, Bantam, *tobitoan*, Md. Borneo: *gamah*, Sarawak. Celebes: *karimenga in sowa*, *mamèrang*, Minahasa, t.t. Lesser Sunda Is. and Moluccas: *mangattah*, Sumba, *tagomatengo*, Halmaheira, *ilun lĕtek*. Philippines: *corazon de angel*, Spanish, Tag., *kanálong*, *magsalóro*, Bis., *payung-payúñgan*, Tag., *tungang-basing*, *unodunod*.

6. Tacca ebeltajae DRENTH, Blumea 20 (1972) 401, f. 2, pl. 2, f. 16–17. — **Fig. 10.**

Tuber globose to subcylindrical, 0.8–1.5 cm high by 1.5–6 by 1–2 cm, provided with an apical cavity from which the leaves and the inflorescences emerge. *Leaves* 1–3, ± reniform to semi-orbicular in outline, 7–*c.* 10-palmatipartite or pedatipartite, 12–20 by 18–20 cm, base attenuate; lobes oblong lanceolate, 6–15 by 2.5–4.5 cm, with attenuated base and acuminate apex; petiole 20–44 by 0.2–0.4 cm, sheath 3–3.5 by 0.4 cm. *Inflorescences* 1 or 2, up to 9-flowered; scape 15–38 by 0.1–0.3 cm. *Involucral bracts* 4, decussate, 2 outer ones oblong ovate, 1–2.3 by 0.4–1 cm, sessile with cuspidate apex; 2 inner ones cordate, 3–4.5 by 1.5–2 cm, with inflexed margins at the basal part, base attenuate, apex acute. *Flowers* 6–9 by 6–12 mm; pedicel 8–20 by 1–3 mm; perianth tube 2–3 by 6 mm. *Perianth lobes* greenish grey to dark red; 3 outer ones ovate, 4–5 by 3–4 mm, apex acute or acuminate; 3 inner ones broadly obovate, 5–6 by 3–5 mm, apex rounded. *Stamens* pale or greenish: adnate portion of the filaments up to 2.5 by 3 mm, free apical portion up to 2 by 1 mm; thecae up to 2 mm long. *Ovary* 3 by 2–4 mm; disk absent, style 2 by 2 mm; stigma lobes 1 by 2 mm. *Fruit* ob-pyramidal; 1.3–1.5 by 0.8–1.2 cm, dark violet to red, pericarp up to 1 mm thick. *Seeds* up to 15, comma-shaped, 4–5 by 2–3 by 2 mm, 12- or 13-ribbed.

Distr. Solomon Is. (Ovau, E. Treasury, New Georgia), 3 collections; in *Malesia*: East New Guinea (W. Sepik Distr.), 1 collection. Fig. 8.

Ecol. Primary and secondary forests at low altitude. *Fl. fr.* Febr.-May.

7. Tacca palmatifida BAKER, J. Linn. Soc. Bot. 15 (1876) 100; LIMPR. Inaug. Diss. Breslau (1902) 58; MERR. Philip. J. Sc. 29 (1926) 357; LIMPR. Pfl. R. Heft 92 (1928) 30; DRENTH, Blumea 20 (1972) 403, pl. 3, f. 26–28. — *T. flabellata* J. J. SMITH, Bull. Jard. Bot. Btzg III, 6 (1924) 79. — *T. breviloba* WARB. *ex* LIMPR. Pfl. R. Heft 92 (1928) 22.

Rhizome cylindric, growing horizontally, 8.5 cm long, 1.5 cm ∅, with the leaves and the inflorescences spaced. *Leaves* 1–3 (–4?), roundish-cordate in outline, palmatifid, 12–35 by 18–50 cm, base attenuate; lobes 5–11 (–13?), ovate, 2.5–14 by 1–9.5 cm, acuminate; petiole 36–60 by 0.3–0.5 cm, sheath 2.5–10 by 0.4–0.7 cm. *Inflorescences* (1–) 3–4, up to 25-flowered; scape 26–60 by 0.2–0.4 cm. *Involucral bracts* 4, decussate, 2 outer ones (broadly) ovate, 1–2.2 by 1–1.3 cm, sessile, acute, acuminate, or cuspidate; inner ones ovate or cordate, 6.5–12.5 by 4.5–7 cm, with inflexed margins at the basal part, base attenuate, apex acuminate or cuspidate. *Flowers* 15–17 by 12–15 mm; pedicel 15–30 by 0.5–1.5 mm, inserted on the basal portion of the inner bracts; perianth tube 4–5 by 9–10 mm. *Perianth lobes*: 3 outer ones broadly elliptic, 6–8 by 8–11 mm, with a rounded, reflexed apex; 3 inner ones with an acuminate apex, 5–6 by 4–5 mm, each composed of a triangular basal portion of 0.5–2 by 4–5 mm, connected by a narrower part of 1–1.5 by 1–2 mm to an obtriangular apical portion of 3–4 by 4–5 mm, the sides of which are reflexed. *Stamens*: adnate portion of the filaments up to 2 by 4 mm, free apical portion up to 3 by 1.5 mm; thecae up to 2.5 mm long. *Ovary* 5–6 by 3–4 mm; disk absent; style 2 by 2 mm, stigmatic lobes 2 by 2 mm. *Fruit*

Fig. 9. Range of *Tacca bibracteata* DRENTH (○) and *T. palmatifida* BAKER (▲).

Fig. 10. *Tacca ebeltajae* DRENTH. *a*. Inflorescence, *b*. habit, both × $^1/_2$, *c*. flower, × $2^1/_2$ (*a–c* BSIP 14243).

Fig. 11. *Tacca celebica* KOORD. *a*. Rootstock of young specimen with one leaf and one petiole, *b–c*. older leaves, *d*. mature leaf, *e*. inflorescence, all × $^{2}/_{5}$ (*a–c*, *e* DE VOGEL 2521, *d* KOORDERS 18919).

ellipsoid to obovoid, 2.2–3 by 1 by 1 cm, pericarp 1 mm thick. *Seeds* ∞, ovoid to ellipsoid, 2–3 by 1–1.5 by 1–1.5 mm, 11–13-ribbed.

Distr. *Malesia*: throughout Celebes. Fig. 9.

Ecol. Forest borders, thickets, on limestone and clay soils, 200–1000 m. *Fl. fr.* Dec.–July.

Vern. *Tilu-tilu*, Mamudju, *totilu*.

8. Tacca celebica KOORD. Med. Lands Pl. Tuin 19 (1898) 641, 311; LIMPR. Inaug. Diss. Breslau (1902) 48; Pfl. R. Heft 92 (1928) 31; DRENTH, Blumea 20 (1972) pl. 2, f. 18. — *T. minahassae* KOORD. Med. Lands Pl. Tuin 19 (1898) 641, 311 (also as *T. minahasae*); LIMPR. Inaug. Diss. Breslau (1902) 48; Pfl. R. Heft 92 (1928) 31. — **Fig. 11.**

Rhizome cylindric, growing horizontally, up to 18 cm long, 1 cm ∅, with the leaves and the inflorescences spaced. *Leaves* 2–6, in outline broadly ovate, palmati-3- or -5-sect, 18–25 by 25–30 cm, lobes entire, or when there are 3 lobes one or two shortly or deeply incised, (ob)-lanceolate, 9–31 by 3–8 cm, stalked, stalk of the central lobes 1.5–2.5 cm long, of the other lobes 0.5–1.5 cm, base attenuate, apex acuminate; petiole 25–45 by 0.2–0.4 cm, sheath 1.5–4 by 0.3 cm. *Inflorescences* 1–5, up to 30-flowered; scape 55–65 by 0.3–0.5 cm. *Involucral bracts* 4, decussate, 2 outer ones ovate, 1–1.5 by 1 cm, sessile, with acute apex; 2 inner ones ovate or cordate, 6.5–8 by 3.5–5 cm, with inflexed margins at the basal part, base attenuate, apex acuminate. *Flowers* 14–18 by 9–10 mm; pedicel 10–20 by 0.5 mm, inserted at the basal portion of the inner bracts; perianth tube 3–5 by 8–9 mm. *Perianth lobes*: 3 outer ones elliptic or ovate, 8–10 by 6–8 mm, with acute apex; 3 inner ones with a rounded to truncate apex, 4.5–5 by 4 mm, each composed of a triangular basal portion of 1–1.5 by 4 mm, connected by a narrower part of 1–2 by 1 mm to a broad elliptical portion of 3–4 by 4–5 mm, the sides of which are reflexed. *Stamens*: adnate portion of the filaments up to 1.5 by 2 mm, free apical portion up to 2 by 2 mm; thecae up to 2 mm long. *Ovary* 3 by 2 mm; disk absent; style 2 by 2 mm; stigmatic lobes 2 by 2 mm. *Fruit* pyramidal, 1.8 by 1 cm, triangular in cross-section, pericarp up to 1 mm thick. *Seeds* up to 26, (sub)rhomboid, 3 by 2 by 1.5 mm, 13- or 14-ribbed.

Distr. *Malesia*: Celebes (northern Peninsula), 3 collections. Fig. 4.

Ecol. Humid, shady places, between bamboo, and in high thickets, at 500–650 m. *Fl. fr.* Dec.–April.

Vern. *Karumenga intalum*, *ruki intjusu*.

ADDENDA, CORRIGENDA ET EMENDANDA

C. G. G. J. VAN STEENIS, *c. s.*

As was done in the preceding volumes, it seemed useful to correct some errors which have crept into the text of volumes 4–7 as well as to add additional data, new records and references to new species which came to my knowledge and are worth recording. Also there are alternative opinions about generic and specific delimitation on most of which comments are given.

Printing errors have only been corrected if they might give rise to confusion.

Volume and page number are separated by a colon. Page numbers provided with either *a* or *b* denote the left and right columns of a page respectively.

Aceraceae

4: 3, 592*a*; 6: 915*a* In Reinwardtia 7 (1965) 142 KOSTERMANS published a new combination *Acer caesium* (REINW. *ex* BL.) KOSTERMANS (as typified by *Laurus caesia* REINW. *ex* BL. Bijdr. (1825) 553) to replace *Acer laurinum* HASSK. (*cf.* Fl. Mal. I, 4, 1954, 592). The latter (earlier known as *A. niveum* BL.) is the proper name, as the combination *A. caesium* (BL.) KOSTERMANS is illegitimate because of *A. caesium* BRANDIS, For. Fl. (1874) 111, Atlas t. 21.

Unfortunately this was overlooked by WHITMORE, Tree Fl. Malaya 2 (1973) 1.

Amaranthaceae

4: 73; 5: 554*a* *Celosia argentea* L. *var. cristata.* A biosystematical study by Dr T. N. KHOSHOO (Bull. Bot. Surv. India 12, 1970, 67–69, 1 fig., 2 pl., 1972) has shown that *C. argentea* must be the ancestral form from which *var. cristata* must be derived.

4: 86*b* C. C. TOWNSEND (Kew Bull. 29, 1974, 464) has transferred *Aerva curtisii* OLIV. to a new genus *Psilotrichopsis* to accommodate this species and *A. cochinchinensis* GAGN. The new genus is said to differ from *Psilotrichum* by verrucose seed and structure of the pollen wall, and from *Aerva* besides by opposite leaves and multinerved petals.

4: 93*a*, 594*b*; 6: 916*a* For *Alternanthera bettzickiana* (REGEL) NICHOLS., which in vol. 4 was distinguished as a variety of *A. ficoidea* (L.) R. BR., KANIS (Contr. Herb. Austr. 1, 1972, 6) made a new combination: *A. manillensis* (WALP.) KANIS. As it later appeared that WALPERS' basionym belonged to another species, KANIS (*ibid.* 7, 1974, 7) cancelled this name in favour of the one accepted in Fl. Mal. vol. 6, *l.c.*

Burmanniaceae

4: 17*a* *Burmannia coelestis* DON.
Add to synonymy: *Cryptonema malaccensis* TURCZ. Bull. Soc. Nat. Moscou 21 (1) (1848) 590, *non Cryptonemia* AGARDH, 1842; Fl. Dahur. 1 (1848); WALP. Ann. 3 (1852) 609. — *Nephrocoelium malaccense* TURCZ. Bull. Soc. Nat. Moscou 26 (1) (1853) 287; Fl. Dahur. 1 (1853). — *Nephrocodum malaccense* WALP. Ann. 6 (1861) 41, *sphalma.*

These three generic names should also have been added to the synonymy of the genus *Burmannia* L. on p. 15. *Cf.* JONKER, A monograph of the Burmanniaceae. Thesis, Utrecht (1938) 121.

Burseraceae (LEENHOUTS)

5: 213 *Protium* BURM. *f.*
Correct in Distr.: In continental Asia there is but one species: *P. serratum* (COLEBR.) ENGL., of which *P. yunnanense* (HU) KALKM. is a synonym. The latter should be (nearly) glabrous and have somewhat larger fruits; these characters appear to be grading, however.

5: 214*b* *Protium macgregorii* (F. M. BAILL.) LEENH.
Add to references: HOOGL. in Walker (ed.), Torres Straits Symp. (1972) 151, f. 8.21 (map).
Add to synonymy: *Dracontomelum papuanum* LAUT. in K. SCH. & LAUT. Nachtr. (1905) 301.
It occurs also in SE. New Guinea: SCHODDE & CRAVEN 4685.

5: 222*b* *Dacryodes costata* (BENN.) H. J. LAM.
Add to description: Inflorescences apparently sometimes exclusively axillary (SAN 75957).

5: 227*a* *Dacryodes macrocarpa* (KING) H. J. LAM.
Add to synonymy: *D. expansa* (*non* H. J. LAM) KALKMAN, Blumea 7 (1954) 510, f. 2 a & b, *typo excl.*; LEENH. Fl. Mal. I, 5 (1956) 228, *ditto*; *ibid.* I, 6 (1972) 919.

5: 227*b* Replace KEY TO THE VARIETIES by the following:

1. Leaves 4- or 5-jugate. Philippines *var.* **merrillii**
1. Leaves up to 3-jugate.
2. Leaflets widest about the middle, equal-sided at base; nerves at a right angle to the midrib. Sarawak, Brunei *var.* **patentinervia**
2. Leaflets widest in the lower half, oblique at base; angle between midrib and nerves acute.
3. Twigs and axial parts of leaves smooth, blackish when dry; leaflets rather thick and stiff, midrib and nerves not sharply prominent on

lower side. Malay Peninsula, Sumatra, Borneo. *var.* **macrocarpa**

3. Twigs and axial parts of leaves scaly and brown when dry; leaflets pergamentaceous, midrib and nerves sharply prominent on lower side. N., E., and S. Borneo *var.* **kostermansii**

5: 228*a* *var. macrocarpa.*

Add to description: Fruit ellipsoid, nearly straight, 3–3$^1/_4$ by 2–2$^1/_4$ by 1$^3/_4$–2 cm.

var. kostermansii (KALKM.) KALKMAN.

Add to description: Fruit ellipsoid, slightly oblique, to flattened ellipsoid, rounded on the side of the fertile cell, angular on the opposite one, 3–4 by 1$^1/_2$–3 by 1$^1/_2$–2$^1/_4$ cm.

var. merrillii H. J. LAM.

Fruit unknown.

Insert after *var. merrillii etc.*:

var. **patentinervia** LEENH. *nov. var.* — *Dacryodes expansa* (*non* H. J. LAM) KALKMAN, Blumea 7 (1954) 510, f. 2 *p.p., typo excl.*; LEENH. Fl. Mal. I, 5 (1956) 228, *ditto.*

Folia 1- vel 2-jugata. Petiolus (2–) 4–8 cm longus. Foliola 6–18 cm longa, basi equilatera; nervi secundarii utrimque 10–14, a costa subpatentes, subrecti, ante marginem valde curvati. Flores ignoti. Fructus applanato-ellipsoidei vel subglobosi, paullo obliqui, parte loculi fertilis rotundata, parte opposita subangulata, 4–5 cm longi, 3$^1/_2$–4 cm lati, 2$^3/_4$–3$^1/_2$ cm crassi, putamine crasso.

Typus: Borneo, Brunei, Bt. Labi F. R., 30 Aug. 1960, fr., J. SINCLAIR & KADIM BIN TASSIM 10492 (L; iso in K, SAR, SING).

Paratypes: KEP 80093; Sarawak For. Dept. 4370, S 16602, S 23655, S 23696.

Distr. *Malesia*: Borneo: Brunei, Sarawak (Miri Distr., Bt. Iju in 3rd Div.).

Ecol. Primary lowland Dipterocarp forest on slopes and ridges; up to *c.* 250 m.

Uses. The fruits (apparently the fleshy pulp) are said to be eaten.

Notes. This is the fruiting material originally identified as *D. expansa.*

Vegetatively, the present species is nearly indistinguishable from *Santiria laevigata* BL.

5: 228*a* *Dacryodes expansa*: Replace by the following:

12. Dacryodes expansa (RIDL.) H. J. LAM, Ann. Jard. Bot. Btzg 42 (1932) 204; Bull. Jard. Bot. Btzg III, 12 (1932) 366, t. 5 f. 21; KALKMAN, Blumea 7 (1954) 510, f. 2 c, *excl. fr. coll.*; LEENH. Fl. Mal. I, 5 (1956) 228, *ditto*; *non* (?) SMYTHIES, Common Sarawak Trees (1965) t. 8; *non* LEENH. Fl. Mal. I, 6 (1972) 919. — *Canarium expansum* RIDL. Kew Bull. (1930) 83.

Small tree. *Branchlets* unknown; buds rufous hairy. *Leaves* (incompletely known) 4- or more-jugate, glabrous; internodes of rhachis *c.* 5 cm long, petiolules 2$^1/_2$–3$^1/_2$, terminal one 5 cm long. *Leaflets* oblong to oblong-lanceolate, 17–23 by 6–7$^1/_2$ cm, brownish when dried; base cuneate, slightly oblique; apex subabruptly acuminate, acumen short, slender, ± acute; nerves 10–12, curved, not joined, prominulous beneath; reticulation lax, rather inconspicuous. *Inflorescences* (only ♂ known) probably lateral on axillary short shoots, up to 24 cm long, lax, glabrous; peduncle up to 6 cm long, branches far apart, the lower up to 10 cm long; pedicels 3–7 mm long, slender. *Flowers* 5 mm long, glabrous. *Calyx* 2 mm, the lobes broadly deltoid. *Petals* ovate-oblong, blunt to ± rounded and minutely inflexed at apex, 4–4$^1/_2$ mm long, very thin. *Stamens* free from the disk. *Disk* thick-annular. *Pistil* in ♂ flowers rather strongly reduced. *Infructescences* and *fruits* unknown.

Distr. *Malesia*: Borneo (Sarawak, near Kuching, known from the type only).

Notes. The fruiting material, identified with the present species and included in the descriptions published by KALKMAN and LEENHOUTS, turned out to represent *D. macrocarpa.* Consequently, the description had to be reduced to the authentic material. The above description is based upon RIDLEY's and LAM's descriptions and a photograph and a drawing of the type in L.

D. expansa may be allied with *D. laxa* and *D. kingii*, with which two it shares the peculiar type of inflorescence. It differs from the former by being nearly glabrous (rare in *laxa*), by its long petiolules (in *laxa* rarely more than 1 cm), by the position of its inflorescence (*laxa* terminal with often some additional lateral ones), by the free stamens (*laxa* apparently always adnate to the disk). *D. kingii* is primarily different by its greater dimensions; furthermore, it shares most characters involved here with *laxa* but is less hairy and the stamens are free from the disk; on the other hand, the nerves are greater in number and stronger prominent beneath.

6: 919*b* *Dacryodes nervosa* (H. J. LAM) LEENH.

Add to description: The indument consists of dense hair tufts rather than of stellate hairs. Reticulations sometimes ± prominent above. Fruits (prob. not fully mature) 2 by 1 cm (SOEPADMO & MAHMUD 1028).

5: 229*b*, 6: 920*a* Add after 16. *Dacryodes nervosa etc.*:

17. Dacryodes multijuga LEENH. *nov. sp.* *Arbor 12 m alta, 10 cm diam. Ramuli ad*

15 mm crassi, fulvo-velutini, glabrescentes; medulla probabiliter cylindro ductorum sclerenchymatosorum resiniferorum ligno adpresso suffulta. Folia immatura ca. 70 cm longa, 11–14-jugata, ± sparse puberula; petiolus 18 cm longus, basi canaliculatus, in dimidio inferiore supra applanatus, medulla evanescente; partes rhachis ad basem 6, ad apicem 4¹/₂ cm longae, supra nodos teretes, infra nodos marginatae; petioluli laterales ca. ¹/₂ cm longi, petiolulus terminalis 2 cm longus, ambo teretes et marginati. Foliola usque ad 14¹/₂ cm longa, 3¹/₂ cm lata, ovato-lanceolata, in sicco tenuiter pergamentacea, olivacea, parte inferiore costae sparse puberula excepta glabra; basis obliqua praesertim in foliolis basalibus, parte acroscopica rotundata, basiscopica cuneata, decurrens; apex gradatim acute acuminatus; costa tenuis utrinque modice prominens; nervi secundarii tenues, utrinque 12 vel 13, inter sese 1–1¹/₂ cm distantes, a costa angulo 80–85° abeuntes, paullo, ante marginem distincte curvati et connati, utrimque modice prominentes; venae intercalares distinctae; rete venulorum densum, utrimque ± prominens. Flores ignoti. Infructescentiae axillares, probabiliter 50 cm longae vel longiores, sparse puberulae, paullo ramosae, ramis pedicello ca. 2 cm longo incluso 4–5 cm longis, tenuibus apice gradatim incrassatis, toro ad ca. 5 mm diam. dilatato. Fructus ellipsoideo-fusiformes, ad 6¹/₂ cm longi, 2³/₄ cm lati, endocarpio 1 mm crasso lignoso.

Typus. Malay Peninsula, Pahang, Jerantut, confluence of Sg. Tekam and Sg. Balol, alt. 60 m, 25-6-1972, F. S. P. NG & I. BELTRAN KEP/FRI 6394 (KEP; iso in L).

Ecol. Lowland forest.

Note. This species is clearly distinct from all other Malesian species by the combination of a large number of leaflets (shared only by *D. longifolia*) and unusually big fruits. Its relationships are not yet clear; in several respects it resembles more the African *sect. Pachylobus* (comparable fruits in *D. edulis*) than the Asian *sect. Tenuipyrena*. The number of locules in the ovary will be decisive but could not be established from the fruits; *Pachylobus* has 2 locules, *Tenuipyrena* 3.

5: 231*a* *Santiria tomentosa* BL.
Add to description: Branchlets exceptionally with some large vascular strands in the pith (SOEPADMO & CHAI S 28154).

5: 231*b* *Santiria mollis* ENGL.
Add to description: Petiole up to 11 cm. *Leaflets* to 5 cm wide. ♀ *Flowers*: calyx outside densely rusty stellate-pubescent, inside densely minutely appressed-hairy. *Corolla* as in ♂ flowers. *Disk* annular, low, fleshy.

5: 232*b*: *Santiria laevigata* BL.
Add note: This species is often nearly indistinguishable from *Dacryodes macrocarpa* in the vegetative state.

5: 238 *Haplolobus* H. J. LAM.
A new revision with descriptions and key was published by P. W. LEENHOUTS, Blumea 20 (1972) 283–310. The number of species was reduced to 13 (among which 2 new *spp.*); out of these, one is restricted to the Solomon Is., all others are partly or entirely Malesian. Also a description is given of seedlings (*l.c.* 311–314). Though this is the fourth revision in only 40 years time, the taxonomy remains so vague that it seems premature to copy the new treatment.

5: 286*a* *Canarium pseudosumatranum* LEENH.
Add to description: Trunk sometimes armed with small spines (KERR 18791). *Leaves* up to 14-jugate, up to 1.30 m long. *Leaflets* up to 26 cm long and 8¹/₂ cm wide; nerves up to *c.* 25 pairs.

6: 926*a* *Canarium vitiense* A. GRAY.
Add to synonymy: *Haplolobus robustus* (*non* H. J. LAM) H. J. LAM, Blumea 8 (1955) 176; *ibid.* 9 (1958) 267. *typ. excl.*
Add to Distr.: W. New Guinea (Numfoor I.: BW 1060); N. Queensland.

Capparaceae (JACOBS)

(conserved spelling; formerly *Capparidaceae*)

6: 68*a* Replace the name *Crateva nurvala* by:
3. Crateva magna (LOUR.) DC. Prod. 1 (1824) 243; MERR. Comm. Lour. (1935) 172; JACOBS, Blumea 12 (1964) 206. — *Capparis magna* LOUR. Fl. Cochinch. 1 (1790) 331. — *Triclanthera corymbosa* RAF. Sylv. Tell. (1838) 108. — *C. nurvala* HAM. [and then the original text].

var. **magna**. — *C. magna* (LOUR.) DC. *l.c.* [and then the original text].

Note. In 1964 *C. magna* was listed under 'Doubtful species' because the type had not been found. Shortly after, Mr N. K. B. ROBSON discovered it in the BM Herbarium, and found that it is a rather narrow-leaved specimen of the later described *C. nurvala*.

Chenopodiaceae

4: 104*a* *Tecticornia cinerea* (F. v. M.) BAIL. must now be called **Tecticornia australasica** (MOQ.) P. G. WILSON, Nuytsia 1 (1972) 280. WILSON treated the taxonomy, typification, ecology, and anatomy at length. In this paper he omitted to mention the detailed study by P. VAN ROYEN, Nova Guinea n.s. 7 (1956) 180–185, fig. 1–2, 2 phot.

4: 105*a* Lines 2 & 3 from top: omit the synonym *Salicornia australasica* MOQ. *ex* SCHINZ and transfer this name to the synonymy of *Tecticornia cinerea* on p. 104*a*.

Combretaceae

4: 548; *Terminalia* L.
5: 564*b*; A most important revision of the Papua-
6: 932*b* sian *spp.* was published by M. J. E. COODE (Contr. Herb. Austr. 2, 1973, 1–33, 5 fig., 1 map), in which 31 *spp.* are recognized (among which 5 new *spp.*), while some names are reduced and several new infraspecific taxa are proposed. Unfortunately there is no key.
6: 932*b* *Terminalia*. In the revised edition of 'Manual of Forest Trees of Papua and New Guinea, Combretaceae' (1969) COODE had included some unpublished new species, 1 from the Bismarcks, 2 from the Solomons, and 1 from New Guinea, which were validated almost simultaneously in Kew Bull. 23 (1969) 299–310, 6 fig.

Connaraceae (LEENHOUTS)

5: 509*b* *Roureopsis acutipetala* (MIQ.) LEENH. *ssp. borneensis* (SCHELLENB.) LEENH. occurs certainly in the Malay Peninsula and also in Peninsular Thailand (S. PHUSOMSAENG 375).
5: 514*a*, Replace: *Rourea minor* (GAERTN.) ALS-
7: 174*b*, TON, Handb. Fl. Ceyl. 6 (Suppl.) (1931)
178*b* 67, '*minus*', corr. Ind. Kew.: LEENH. Fl. Mal. I, 5 (1958) 514.
5: 515*b* Add to Distr.: Flores.
5: 523*b* *Ellipanthus tomentosus* KURZ *var. gibbosus* (KING) LEENH.
Add to description: Petiole to $2^1/_2$ cm; leaf to 26 by 10 cm, tomentose on midrib and nerves beneath, clearly peltate at base (SHAH & NOOR MS 1918), then sometimes rounded (S. P. 10).
5: 526 Second line from bottom: change $3^1/_2$ into $3^1/_2$–$4^1/_2$.
5: 533*b* *Connarus paniculatus* ROXB.
Add to description: Petiolules $^1/_2$–1 cm. Leaflets up to 7 cm wide, base sometimes cuneate, veins nearly invisible to distinct beneath. Fruits up to $4^1/_2$ by 2 cm, inside sparsely to rather densely pubescent.
Add to Distr. (bottom line): Kelantan; according to VIDAL, Fl. Thailand 2 (1972) 129 also in Peninsular and SE. Thailand.
5: 534*a* Add to Ecol. (top line): on limestone. *Fr.* Aug.
Add to Note: A specimen from Kelantan (S. C. CHIN 1424) is slightly deviating and shows the bigger and more woody fruits of *var. hainanensis* VIDAL.

Convolvulaceae

4: 446*b*; Insert before 7. *Merremia quinquefolia*:
6: 939*b*

6b. Merremia steenisii OOSTSTR. Blumea 20 (1972) 127, fig. 1 a–h.

Distr. *Malesia*: New Guinea (Sepik Distr.), one collection; in grassland at low altitude.

Note. This species is closely allied to *M. aniseiifolia* OOSTSTR. (see Fl. Mal. 6: 939*b*), also endemic in New Guinea, but differing in being densely haired, the narrower, thicker leaves, the absence of warts on the sepals, the slightly pilose midpetaline bands, the ± shorter, lower-inserted stamens, and not twisted mature anthers.

4: 447*a* *Merremia quinata* (R. BR.) OOSTSTR.:
6: 939*b* Blumea 20 (1972) 129.
Add to Distr.: Also mainland of New Guinea.

Cyperaceae

7: 753 Add at the end: 'To be concluded.'
The treatment of *Carex* and *Uncinia* is to be concluded in a later volume. Unfortunately Dr KERN's Mss were not finished at the time of his death.

Datiscaceae

4: 385 *Tetrameles nudiflora* R. BR.
Add to references: HYLAND, Blumea 20 (1972) 338.
4: 387*b* Add to Distr.: Now also found in the Cape York Peninsula, N. Queensland.

Dichapetalaceae (LEENHOUTS)

5: 305 *Dichapetalum* THOU.
Add to generic references: BRETELER, Meded. Landbouwhogeschool Wageningen 73, 13 (1973) 1–123.
Add to generic description: Pistil exceptionally 4-merous.

Taxonomy. W. PUNT (Rev. Palaeobot. Palynol. 19, 1975, 1–97) examined the pollen morphology of the entire genus. In this work the Malesian *spp.*, as far as studied by him, are arranged in the following groups in assumed phylogenetic sequence:

1. *D. bangii* cluster, to which belong the *papuanum* group (*D. papuanum*, *sessiliflorum*, *tricapsulare*, and *vitiense*) and the *timoriense* group (*timoriense*).
2. *D. heudelotii* cluster to which belong the *longipetalum* group (*griffithii*, *longipetalum*, *laurocerasus*).
3. *D. gelonioides* cluster to which belong the *gelonioides* group (*gelonioides*, *hel-*

ferianum) and the *grandifolium* group (*grandifolium*, *setosum*, *steenisii*).
My only criticism regards the position of *D. tricapsulare* that to me seems distinctly allied with *D. gelonioides*, though slightly more primitive than that species.

5: 310*a* *Dichapetalum papuanum* (BECC.) BOERL.
Add to description: Pistil exceptionally 4-merous (G. STOCKER 656, Queensland). Seeds glossy orange-red.

5: 315*b* *Dichapetalum helferianum* (KURZ) PIERRE.
Add the following note: According to pollen-morphological arguments its relationship may be with *D. gelonioides*, as pointed out by PUNT (Rev. Palaeobot. Palynol. 19, 1975, 25).

Dilleniaceae (HOOGLAND)

4: 141 *Tetracera* L.
After the treatment in Fl. Mal. I, 4 (1951) two important papers have been published, *viz* a revision of the genus in the eastern Old World by HOOGLAND (Reinwardtia 2, 1953, 185–224, pl. 1) and a world revision with general observations on chemotaxonomy, evolution, dispersal, *etc.* by KUBITZKI (Bot. Mitt. München 8, 1970, 1–98, 10 fig.).

4: 143*b* Change 3. *Tetracera asiatica* into:
3. Tetracera sarmentosa (L.) VAHL, Symb. Bot. 3 (1794) 70; HOOGL. Blumea 9 (1959) 588; KUBITZKI, Bot. Mitt. Münch. 8 (1970) 52. — *Delima sarmentosa* L. Gen. Pl. ed. 5 (1754) *pag. ult.* — *Seguieria asiatica* LOUR. Fl. Coch. (1790) 341. — *T. asiatica* (LOUR.) HOOGL. Fl. Mal. I, 4 (1951) 143; Reinwardtia 2 (1953) 193, f. 2 (map).
Notes. HOOGLAND (1951) listed *Delima* and *Tetracera sarmentosa* in the synonymy of 1. *Tetracera scandens* (L.) MERR., from which they should be removed (*cf.* HOOGLAND, 1959).
The subspecies described by HOOGLAND (1951, *l.c.*; Reinwardtia 2, 1953, 195–196, f. 2) were transferred by him to *T. sarmentosa* (1959, *l.c.*). KUBITZKI (*l.c.* 53) found them well described and distinguished, but of lower status than the infraspecific taxa accepted by him for American and African species.

4: 146*b* *Tetracera indica* (CHRISTM. & PANZ.) MERR.
Add: Note. The recent record from Borneo (HOOGL. Blumea 9, 1959, 589) is based on an incorrectly identified specimen of *T. akara* (BURM. *f.*) MERR.

4: 147*a* *Tetracera akara* (BURM. *f.*) MERR.
Add to Distr.: Philippines (Basilan) (HOOGL. Blumea 9, 1959, 589).

4: 148*a* *Tetracera arborescens* JACK.
Distr.: The single locality in Java, with a question mark, should be deleted. It is one of many errors made in labelling specimens of the KORTHALS collection. The specimen probably came from W. Central Sumatra.

4: 150*b* *Hibbertia scandens*:
The correct authorship of this species is (WILLD.) GILG in E. & P. Nat. Pfl. Fam. 3, 6 (1893) 117.
Add to Distr.: SE. New Guinea (Astrolabe Range).

4: 154 *Dillenia* L.
In Fl. Mal. I, 4 (1951) HOOGLAND published a number of taxa of *Dillenia* with English descriptions only. These names were validated with Latin descriptions and the species illustrated in his revision of the genus (Blumea 7, 1952, 1–145). For the new species, the appropriate references are given below.

4: 156 In the KEY TO THE SPECIES, replace the first entry of fork 3 by:
2a. Sepals ∞. Flowers not fully opening, the petals coherent in anthesis, cucullate, *c.* 10 cm long, red **1. D. pteropoda**
2a. Sepals 5. Flowers fully opening, the petals spreading, flat, *c.* 5 cm long, white or yellow.
3. All stamens of approximately the same length. Flowers white **1a. D. papyracea**

4: 157 Insert between second entry of fork 15 and first entry of fork 16:
15a. Sepals *c.* 45–55 by 35 mm; petals *c.* 55 mm long. Leaves large (up to 45 by 35 cm), *c.* 10–15-nerved **7a. D. cyclopensis**
15a. Sepals at most *c.* 25 by 22 mm; petals up to *c.* 35 mm long. Leaves smaller.
Amend second entry of fork 7 to read:
7. Innermost stamens longer than the outer ones, *usually* with the apical part reflexed outward *in bud.*
Replace second entry of fork 21 by:
21. Petiolar wings narrower. Flowers smaller, with spreading petals, up to 10 cm diam.; or with petals not spreading, cucullate, falling collectively, up to 50 mm long.
Replace fork 22 by:
22. Leaves rather coriaceous, 5–8-nerved, up to *c.* 12 by $7^1/_2$ cm **21. D. diantha**
22. Leaves not coriaceous, 8–20-nerved, usually distinctly larger.
Replace second entry of fork 23 by:
23. Apex rounded to acute. Plant not cauliflorous. Flowers yellow.
23a. Innermost stamens straight or slightly curved; length of stamens gradually decreasing towards the numerous (60 or more) stamino-

des on the outside of the androecium.

23b. Flowers solitary. Sepals to *c.* 30 mm long in flower. Staminodes *c.* 60 . **9a. D. insularum**

23b. Flowers in 2- or 3-flowered inflorescences. Sepals *c.* 35–45 mm long in flower. Staminodes over 300 . . . **9b. D. nalagi**

23a. Stamens in 2 distinct groups: the innermost ones reflexed at apex; the outer ones straight or slightly curved, not very different in length; staminodes few (up to *c.* 25) or absent.

4: 158*a* *Dillenia pteropoda* (MIQ.) HOOGL.

In 1951 this species was known from the Moluccas only from sterile specimens, very similar to leaf material of *D. papyracea* MERR. A recent collection with flowers has shown that two species are involved, as follows:

1. Dillenia pteropoda (MIQ.) HOOGL. Fl. Mal. I, 4 (1951) 158, *p.p.*; Blumea 7 (1952) 28, *p.p.*; *ibid.* 9 (1959) 577, f. 1. — *Wormia pteropoda* MIQ. Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 77.

Large tree, up to *c.* 30 m tall, up to 50 cm ⌀. *Leaves* elliptic, subcoriaceous, *c.* 17–21-nerved, 30–60 (–90) by 16–40 (–60) cm, blade with rounded to obtuse apex, obtuse to acute base and entire to slightly undulate-dentate margin. Petiole *c.* 5–10 cm long, wings up to $2^1/_2$ cm broad, often caducous. *Flowers* solitary, terminal, probably never expanding, sepals only slightly diverging in anthesis, petals falling without spreading. Pedicel *c.* 15–20 mm long, 5 mm thick, without bracteoles. Sepals *c.* 18, increasing in size towards centre of flower, from orbicular *c.* 20 by 20 mm to broad-elliptic *c.* 50 by 43 mm, glabrous. Petals 7, red, narrowly obovate, cucullate, *c.* 10 by 4 cm. Stamens *c.* 220, slightly curved in bud, all of approximately the same length, 45 mm long. Carpels 10, *c.* 17 by 6 mm, glabrous, with 23 mm long styles, each with *c.* 15–20 ovules.

Distr. *Malesia*: Moluccas (Halmahera, Batjan) and W. New Guinea (Salawati, Vogelkop).

Ecol. In primary forest of low altitude.

1a. Dillenia papyracea MERR. Philip. J. Sc. 9 (1915) Bot. 520; En. Philip. 3 (1923) 60. — *D. megalophylla* MERR. Philip. J. Sc. 14 (1919) 421; En. Philip. 3 (1923) 60. — *Wormia papyracea* GILG & WERDERM. in E. & P. Nat. Pfl. Fam. ed. 2, 21 (1925) 35. — *D. pteropoda* (MIQ.) HOOGL. Fl. Mal. I, 4 (1951) 158, *p.p.* (*typ. excl.*); Blumea 7 (1952) 28, *p.p.*

The description of *Dillenia pteropoda* in Fl. Mal. I, 4 (1951) 158*a* fits this species.

Distr. *Malesia*: Philippines (N. Luzon, Mindanao).

Ecol. In primary forests, often along streams, from sea-level up to 500 m.

Vern. *Tukoran*, Lan., *malaigang*, Sul.

4: 159*a* *Dillenia celebica* HOOGL.: Blumea 7 (1952) 24, f. 3 c–e.

Dillenia ovalifolia HOOGL.: Blumea 7 (1952) 33, f. 3 a–b; *ibid.* 9 (1959) 579.

4: 159*b* Add to Distr.: Waigheo and Sorong.

Add to Notes: Further collections have obscured the differences between *var. ovalifolia* and *var. sericea* HOOGL. so that these entities can no longer be maintained as distinct varieties. The petals in these collections were recorded to be pink or red, whereas previously only white petals were known.

4: 161*a* Insert after 7. *Dillenia papuana*:

7a. Dillenia cyclopensis HOOGL. Blumea 9 (1959) 585, f. 7.

Tree, up to *c.* 20 m tall, 40 cm ⌀, with up to 10 m bole, with reddish brown bark peeling off in flakes. *Leaves* cordate-elliptic or elliptic to ovate, 10–15-nerved, 20–45 by 16–35 cm, with rounded to slightly retuse apex, slightly cordiform or rounded to obtuse base, and undulate margin, glabrous. Petiole 5–10 cm long, the wings oblong up to 25 mm broad. Raceme 3-flowered, up to 6 cm long with tortuous axis. *Flowers* not expanding, the sepals only slightly diverging, the petals falling off collectively without spreading. Sepals 5, *c.* 45–55 by 35 mm, short hirsute outside. Petals 5, cucullate when falling, *c.* 55 by 18 mm. Stamens *c.* 360, all of approximately same length, 18–20 mm long; a few (*c.* 10) staminodes on the outside. Carpels 8–11, *c.* 17 by 7 mm, with *c.* 20 mm long styles, each with *c.* 24 ovules. *Fruit* dehiscent. Carpels 28 by 16 mm. Seeds unknown.

Distr. *Malesia*: NW. New Guinea (Cyclops Mts).

Ecol. Locally common in primary and secondary forest, from near sea-level up to *c.* 500 m altitude.

4: 161*a* *Dillenia montana* DIELS.

Add to literature: HOOGL. Blumea 9 (1959) 579.

Change in description: Sepals 5 (or 7), variable in size from 29 by 21 to 35 by 30 mm. Petals 5 or 6, yellow, *c.* 36 by 32 mm. Carpels 8–11, *c.* 14–18 by 3–4 mm with 9–11 mm long, recurved styles. *Fruit* dehiscent. Carpels *c.* 30 by 15 mm, 1–3-seeded. *Seeds* 5 by 5 mm, black, with 7 mm long aril split on one side.

4: 161*b* Insert after 9. *Dillenia schlechteri*:

9a. Dillenia insularum HOOGL. Blumea 9 (1959) 583, f. 7.

Tree up to *c.* 20 m tall, 30 cm ⌀, with dark brown or brownish grey, somewhat scaly bark. *Leaves* elliptic-oblong or elliptic, *c.* 10–13-nerved, 10–25 by $5^1/_2$–15 cm, with rounded apex, obtuse to rounded base, and slightly undulate margin. Petiole 3–7 cm long, with narrow lanceolate to linear, 3–5 mm broad wings wholly caducous or usually leaving a pair of small auricles at base of blade. *Flowers* solitary, just after flowering a globular bud *c.* 2–$2^1/_2$ cm ⌀. Pedicel $2^1/_2$–$7^1/_2$ cm long, with a single linear-lanceolate 10–30 mm long bracteole. Sepals 5, *c.* 25–30 by 20–30 mm, densely shortly sericeous outside. Petals unknown. Stamens and staminodes slightly curved in bud; the staminodes (*c.* 60) on the outside, 2–5 mm long; the stamens (*c.* 260) 6–10 mm long. Carpels 7–9, *c.* 10 by 6 mm, with 7 mm long styles, each with 6–8 ovules. *Fruit* dehiscent. Carpels 20 by 16 mm, 1–2-seeded. *Seeds* $4^1/_2$ by $2^1/_2$ mm, dark brown, enclosed by $5^1/_2$ mm long membranous aril.

Distr. *Malesia*: Islands to the SE. of New Guinea (Sudest, Misima).

Ecol. In lowland forest, up to 350 m alt.

9b. Dillenia nalagi HOOGL. Blumea 9 (1959) 581, f. 2–6.

Large tree up to 30 m tall, 60 cm ⌀, with short bole, dull red-brown flaky bark, and reddish wood. *Leaves* ovate or obovate to elliptic-oblong, *c.* 15–23 (–32)-nerved, (18–) 30–65 (–80) by (10–) 18–30 cm, with rounded, often slightly retuse, apex, obtuse base, and undulate to shallowly dentate margin. Petiole 10–18 (–25) cm long, with linear-lanceolate, up to 18 mm broad, densely sericeo-hirsute, wholly caducous wings. Racemes 2 (–3)-flowered, up to *c.* 15 cm long, with axis densely sericeo-hirsute and usually curved backward. *Flowers* not expanding, the sepals only slightly diverging in anthesis, the petals falling off collectively without spreading. Sepals 5, *c.* 35–45 by 28–35 mm. Petals 5, yellow, cucullate when falling, *c.* 35–50 by 18–23 mm. Androecium with *c.* 325 10–15 mm long stamens on the inside and *c.* 365 3–10 mm long staminodes. Carpels 10–11, *c.* 8 by $3^1/_2$ mm with *c.* 9 mm long styles, each with *c.* 6–16 ovules. *Fruit* dehiscent, the sepals enlarged up to *c.* 65 by 40 mm. Carpels *c.* 30–35 by 30–34 mm, up to 2-seeded. *Seeds c.* 6 by $4^1/_2$ by 3 mm, enclosed by rather thick fleshy white *c.* 7–8 mm long aril.

Distr. *Malesia*: SE. New Guinea, restricted to the Northern District.

Ecol. Common in grasslands, regrowth forest, and in rain-forest at low altitude (below 100 m).

Vern. *Nalagi*, Robinson Bay area.

4: 161*b* *Dillenia quercifolia* (LANE POOLE) HOOGL. Add to Distr.: SE. New Guinea, including Fergusson I. (HOOGL. Blumea 9, 1959, 583).

4: 162*a* *Dillenia fagifolia* HOOGL.: Blumea 7 (1952) 74, f. 9 a–d.
Dillenia marsupialis HOOGL.: Blumea 7 (1952) 66, f. 8 e.

4: 162*b* *Dillenia reifferscheidia* VILLAR.
Add to synonymy: *Wormia luzonensis* BAILL. Hist. Pl. 1 (1868) 114.

4: 164*a* *Dillenia talaudensis* HOOGL.: Blumea 7 (1952) 59, f. 8 a–d.

4: 165*a* *Dillenia diantha* HOOGL.: Blumea 7 (1952) 57, f. 7.

4: 165*b* *Dillenia castaneifolia*:
The correct authorship is (MIQ.) DIELS, Bot. Jahrb. 57 (1922) 438.
The names of a number of *Dillenia* species were incorrectly attributed to MARTELLI by DUR. & JACKS. Ind. Kew. Suppl. 1 (1902) 136. As DUR. & JACKS. only excepted these as synonyms of the names under *Wormia*, these binomials were not validly published and must be attributed to later authors.

4: 166*a* Change 25. *Dillenia eximia* into:

25. Dillenia grandifolia WALL. [Cat. (1829) *n.* 946, *nomen*] *ex* HOOK. *f.* & TH. Fl. Ind. 1 (1855) 71; HOOK. *f.* Fl. Br. Ind. 1 (1872) 38; RIDL. Fl. Mal. Pen. 1 (1922) 11; CORNER, Ways. Trees (1940) 203; HOOGL. Fl. Mal. I, 4 (1951) 174; Blumea 7 (1952) 134; KOCHUMMEN & WHITMORE, Gard. Bull. Sing. 24 (1969) 3; KOCHUMMEN, Tree Fl. Malaya 1 (1972) 188, f. 2; HOOGL. Fl. Thailand 1, 2 (1972) 100. — *D. eximia* MIQ. Fl. Ind. Bat. Suppl. (1861) 620; HOOGL. Fl. Mal. I, 4 (1951) 166, with further synonymy.

Note. KOCHUMMEN & WHITMORE were able to show that the type of *D. grandifolia*, which consists of sapling leaves only, fits in with the species previously described under the name *Dillenia eximia* MIQ.

4: 166*b* *Dillenia borneensis* HOOGL.: Blumea 7 (1952) 80, f. 9 e–h.

4: 168*b* *Dillenia luzoniensis*:
Authorship and synonymy are to be corrected as follows:

29. Dillenia luzoniensis MERR. Philip. J. Sc. 1 (1906) Suppl. 95. — *Wormia luzoniensis* VIDAL, Rev. Pl. Vasc. Filip. (1886) 36, *non W. luzonensis* BAILL. (1868).

Note. Because of the earlier name of BAILLON, not listed in Index Kewensis, the authorship of this species as given pre-

viously is incorrect. *Wormia luzonensis* BAILL. = *Dillenia reifferscheidia* VILLAR.

4: 174*a* *Dillenia grandifolia* under 'Excluded and Doubtful':
Dillenia grandifolia HOOK. *f.* & TH. is the correct name for 25, previously entered as *Dillenia eximia* MIQ.

Ericaceae

6: 474 *Rhododendron* L.
Dr SLEUMER has published an important supplement on his revision in Blumea 21 (1973) 357–376, with 9 new *spp.* from Borneo, New Guinea, and New Britain, many important new records, and notes on hybridisation.

6: 669, 670 ANDRES had, for the saprophytic Asian *Ericaceae*, a fairly small generic concept, distinguishing 3 genera for 4 species, in which he was followed by SLEUMER, who in Fl. Mal. treated the Malesian *spp.* under *Andresia* (*Wirtgenia*) and *Monotropastrum*. In KENG's opinion (Reinwardtia 9, 1974, 82–84) they all belong to one genus *Cheilotheca*. KENG gave a key with references to the 4 *spp.*; he did not make infrageneric distinctions.

6: 878 *Agapetes* D. DON.
P. F. STEVENS (Not. R. Bot. Gard. Edinb. 32, 1972, 13–28, 5 fig.) reinstated *Paphia* SEEM. as a new subgenus to accommodate 18 Papuan-Melanesian *spp.* and 1 *sp.* from Malaya; the first are distinguished as *sect. Paphia*, the latter as *sect. Pseudagapetes* SHAW. Three new *spp.* and one new *ssp.* are described from New Guinea. An extensive anatomical study was made.

6: 885 *Dimorphanthera* F. v. M.
P. F. STEVENS reviewed the delimitation and relationships of this genus, giving also notes on and new records of some Papuasian *spp.* (Contr. Herb. Austr. 8, 1974, 1–34, 9 fig.). He concluded that *Vaccinium sect. Pachyanthum* SLEUM. (Fl. Mal. 6: 747) should be transferred to *Dimorphanthera* and made the 5 new combinations necessary. He concluded also that *Dimorphanthera* is closely related to the west Central and tropical American genus *Satyria* and suggested that the pair is an other example of trans-Pacific tropical distribution.

For the New Guinean species a number of reductions are made: *D. tridens* and *D. declinata* are reduced to *D. kempteriana*, *D. brassii* and *D. clemensiae* to *D. anchorifera*, *D. gracilis* to *D. denticulifera*, *D. splendens* is considered to be a variety of *D. elegantissima*, *D. alba* is removed from the synonymy of *D. forbesii* and kept distinct.

Furthermore, 5 new *spp.* and 1 new variety were described.

Flacourtiaceae

5: 2 Add: *Palynology*. J. SCHAEFFER (Blumea 20, 1972, 65–79) has made a study of pollen in *Hydnocarpus* and related genera. In the genus two subtypes can be distinguished. Within the family the pollen is ± isolated, but the related monotypic genus *Chlorocarpa* (from Ceylon) has rather similar pollen.

In sculpture there exists some resemblance to that in *Paropsia*, which was classified with either *Flacourtiaceae* or *Passifloraceae*, but newly incorporated in the latter family, according to DE WILDE (Blumea 19, 1971, 99–104; Fl. Mal. I, 7, 1972, 406).

5: 8 *Scolopia* SCHREB.
Through the new world revision of the genus by SLEUMER (Blumea 20, 1972, 25–64) the following additions and changes are necessary:

5: 8, 10*a* *Scolopia macrophylla* (W. & A.) CLOS; SLEUM. Blumea 20 (1972) 35.
Add to Distr.: Malay Peninsula.

5: 11*b* Insert after 3. *Scolopia spinosa*:

3a. Scolopia steenisiana SLEUM. Blumea 20 (1972) 34. — *S. kermodei* (*non* FISCHER) STEEN. Blumea 17 (1969) 270; *cf.* SLEUM. Fl. Mal. I, 6 (1972) 943b.

Leaves with 2 distinct glands at the base of the lamina or apex of the petiole. Extra-staminal disk glands absent. Inflorescence glabrous (only the pedicels puberulent), rather stoutish and dense-flowered. Pedicels robust, 3–5 mm at anthesis. Berry subglobular.

Distr. *Malesia*: Malay Peninsula (Ulu Kelantan, Gua Musang), on summit of limestone hill.

Note. By the characters mentioned above and taken from SLEUMER's key to be distinguished from *S. spinosa*. *S. kermodei* is only known from Burma and Andaman Is.

5: 11*b*, 12*a* *Scolopia luzonensis* (PRESL) WARB.; SLEUM. Blumea 20 (1972) 38.
Add to Distr.: Lesser Sunda Is. (Flores).

5: 12*b* *Scolopia novo-guineensis* WARB.; SLEUM. Blumea 20 (1972) 42. — *S. nitida* C. T. WHITE, J. Arn. Arb. 10 (1929) 243; SLEUM. Fl. Mal. I, 5 (1954) 12.
Add to Distr.: New Britain, New Ireland.

Goodeniaceae (LEENHOUTS)

5: 336, 6: 950*a* *Goodenia* J. E. SMITH.
Distr., change to: Four species known from outside Australia/Tasmania.
The first couplet of the key as given in 6: 950a should accordingly be changed as follows:

1. Plant 20 cm high or more. Leaves linear-lanceolate.
1a. Leaves mainly in a basal rosette; flowers arranged in a terminal inflorescence . . **3. G. purpurascens**
1a. Leaves nearly exclusively cauline; flowers axillary **4. G. armstrongiana**
1. Plant up to 10 cm high. Leaves ovate or obovate.

4. Goodenia armstrongiana DE VRIESE, Nat. Verh. Holl. Mij. Wet. II, 10 (1854) 138, t. 24; BTH. Fl. Austr. 4 (1864) 73; KRAUSE, Pfl. R. Heft 54 (1912) 76.

Erect strigose annual up to *c.* 30 cm high, with few long and slender branches from the base. *Leaves* nearly exclusively cauline, sessile, linear-lanceolate, up to 3 cm by $1^1/_2$ mm, herbaceous, entire, acute. *Flowers* solitary, axillary, on patent, up to 2 cm long, filiform pedicels; bracteoles 0. *Calyx lobes* lanceolate, $1^1/_2$ by 0.3 mm, acute. *Corolla* 1 cm long, yellow, at base reddish, thinly villous, the lobes broadly winged. *Capsules* ellipsoid, 5 mm long. *Seeds c.* 10, ovate, $1^1/_2$ by 1 mm, granulate, with a marginal rib.

Distr. Australia (Northern Terr., Arnhem Land) and *Malesia*: New Guinea (Papua, Western Distr., near Morehead Patrol Post, PULLEN 7161).

Ecol. Open sandy patch in savannah woodland; alt. *c.* 25 m. *Fl. fr.* Aug.

Notes. The present species is included by KRAUSE in his *sect. Ebracteolatae ser. Foliosae.*

We owe the identification of the New Guinea specimen to Prof. R. C. CAROLIN, Sydney.

Haloragaceae

7: 244*b* *Haloragis micrantha* (THUNB.) R. BR. *ex* S. & Z. and Fig. 4.
Add to Distr.: N. Sumatra (Gajo Lands).

7: 253*a* Change 4. *Myriophyllum brasiliense* into: **4. Myriophyllum aquaticum** (VELL.) VERDCOURT, Kew Bull. 28 (1973) 36. — *Enhydria aquatica* VELL. Fl. Flum. (1825) 57, Icon. 1 (1835) t. 150. — *M. brasiliense* CAMBESS. in A. St. Hil. Fl. Bras. 13, 2 (1829) 182; VAN DER MEIJDEN, Fl. Mal. I, 7 (1971) 253.

Hydrocharitaceae

5: 388*b* Change 1. *Vallisneria gigantea* into: **1. Vallisneria natans** (LOUR.) HARA, J. Jap. Bot. 49 (1974) 129–137. — *Physkium natans* LOUR. Fl. Coch. (1790) 663. — *V. gigantea* GRAEBNER, Bot. Jahrb. 49 (1912) 68; DEN HARTOG, Fl. Mal. I, 5 (1957) 388.

Note. This is the proper name if the Indo-Australian taxon is kept separate from *V. spiralis* L.

5: 396*a* Change 1. *Limnobium stoloniferum* into: **1. Limnobium laevigatum** (H. B. *ex* WILLD.) HEINE, Adansonia 8 (1968) 314–316; C. V. MORTON, Contr. U. S. Nat. Herb. 38 (6) (1973) 270. — *Salvinia laevigata* H. B. *ex* WILLD. Sp. Pl. ed. 4, 5 (1810) 537. — *L. stoloniferum* (G. MEYER) GRISEB. Fl. Br. W. Ind. (1861) 506; DEN HARTOG, Fl. Mal. I, 5 (1957) 396.

Icacinaceae

7: 23 Insert in the key, fork 19, first line: 'cm' after 3.5–4.

7: 42*b* *Hartleya inopinata* SLEUM.
Add to Distr.: Bosavi Mts, S. Highlands, 1350–1550 m (JACOBS 8810, fr.).

7: 43*b* In Fig. 15 numbers 3 and 4 are interchanged.

7: 60*b* *Stemonurus malaccensis* (MAST.) SLEUM.
Add to Distr.: Sumatra.

7: 70*b* *Iodes cirrhosa* TURCZ.
Line 11–13 from top: delete the synonym *I. horsefieldii* BAILL.

7: 80 Delete *4. P. malacothrix* from the key.

7: 83*b* Transfer *Phytocrene malacothrix* SLEUM. to 'Excluded' on p. 87*b*. It is *Legnephora minutiflora* (K. SCH.) DIELS; FORMAN, Kew Bull. 27 (1972) 279 (*Menispermaceae*).

7: 87*b* Fourth line under 3. *Phytocrene macrophylla* (BL.) BL. *var. dasycarpa*: 'which is *var. macrocarpa*' must be changed into 'which is *var. macrophylla*'.

Loganiaceae (LEENHOUTS)

6: 294 Add to Morphology: For inflorescences see TIREL-ROUDET, Fl. C. L. & V. 13 (1972) 8–11.

6: 296 Add to (7) *Androya*: See revision by LEEUWENBERG, Acta Bot. Neerl. 22 (1973) 456–459.
Add to (26) *Mitreola*: See revision by LEEUWENBERG, Meded. Landb. Hogesch. Wageningen 74–23 (1975) 1–28.

6: 317*b* *Fagraea ceilanica* THUNB.
Add to Distr.: Solomon Islands.

6: 328*b* *Fagraea auriculata* JACK *ssp. auriculata.*
Add to Distr.: Flores.

6: 331*a* *Fagraea resinosa* LEENH.
Add to Distr.: Sarawak (5th Div., Ulu Sg. Pandarasan).
Add to Ecol.: Kerangas forest on sandy soil, at c. 900 m.

6: 343 *Gelsemium* JUSSIEU.
Add to literature: ORNDUFF, J. Arn. Arb. 51 (1970) 1–17; TIREL-ROUDET, Fl. C. L. & V. 13 (1972) 68–70.
Strychnos LINNÉ.
Add to literature: BISSET *et al.* Lloydia 36 (1973) 179–201.

6: 347*a* *Strychnos ignatii* BERG.
Add to synonymy: *S. lanceolaris* MIQ.

Sum. (1861) 551, 227; HILL, Kew Bull. (1911) 295, excl. fl. material; LEENH. Fl. Mal. I, 6 (1962) 357, *ditto*.

6: 347*b* Add to description: Pericarp up to $1^1/_2$ cm thick.
Add to Distr.: Sumatra (Palembang), N. & S. Vietnam, Hainan (*cf.* TIREL-ROUDET, 1972).

6: 351*a* *Strychnos ovata* HILL.
Add to synonymy: *S. lanceolaris* MIQ. *sensu* HILL, Kew Bull. (1911) 295, as to fl. specimens; LEENH. Fl. Mal. I, 6 (1962) 357, *ditto*.
Add to description: Calyx to $1^1/_2$ mm. Corolla inside sometimes woolly only at the tips of the lobes.
Add to Distr.: Sumatra, Hainan, and Indo-China (*cf.* TIREL-ROUDET, 1972).

6: 357*b* *Strychnos lanceolaris* MIQ.: This name has to be reduced to *S. ignatii* BERG., *vide supra*; the flowering material represents *S. ovata* HILL.

6: 375, 959*b* *Mitreola* LINNÉ.
Add to literature: LEEUWENBERG, Meded. Landb. Hogesch. Wageningen 74–23 (1975) 1–28 (revision).

6: 377*b*, 960*a* *Mitreola sphaerocarpa* (LEENH.) LEENH.
A 3rd collection is from Sarawak (S 30397), Mt Api, at only 120 m. *Fl. fr.* Sept.; on limestone; described as a shrublet 30 cm high (S 30752).
Note. The name *Cynoctonum pedicellatum* (BTH.) B. L. ROB. to be replaced by *Mitreola pedicellata* BTH. This species is also known from Nepal and Bhutan.

6: 378*b* *Spigelia anthelmia* LINNÉ.
Add to Distr.: New Ireland (NGF 40480).

Nyctaginaceae

6: 467*a* *Pisonia aculeata* L.; STEEN. Blumea 20 (1972) 434.
Add to synonymy: *Samyda macrophylla* WILLD. Sp. Pl. 2 (1799) 625, *non Pisonia macrophylla* LINK, 1821. — *Calpidia macrophylla* BOJER, Hort. Maur. (1837) 265. —*P. macrophylla* (BOJER) CHOISY in DC. Prod. 13, 2 (1849) 446.
Note. WILLDENOW's type was based on a specimen collected by KLEIN in India (herb. WILLDENOW, no. 8340, in B); his name was omitted from Indian botany.

Oxalidaceae

7: 158*a* Change 5. *Oxalis deppei* into:
5. Oxalis tetraphylla CAV. Ic. Descr. 3 (1795) 19, t. 237; DENTON, Publ. Mus. Michigan State Univ., biol. ser. 4 (1973) 590. — *O. deppei* LODD. Bot. Cab. 15 (1828) 1500; VELDKAMP, Fl. Mal. I, 7 (1971) 158.
The note under this species on p. 158*b* should be deleted; it was due to a misplaced trust in KNUTH's revision. It should be replaced by:
Note. The Malesian specimens belong to *var. tetraphylla*.

Passifloraceae

7: 406 See Taxonomy and Key: The inclusion of *Paropsia* in *Passifloraceae* is supported by the systematic wood-anatomy according to R. B. MILLER (J. Arn. Arb. 56, 1975, 95).

7: 411 Second line from top, read: *P. incarnata* L.

Pedaliaceae

4: 217*a* Change 1. *Sesamum indicum* into:
1. Sesamum orientale LINNÉ, Sp. Pl. (1753) 634; GAERTN. Fruct. 2 (1791) 132, t. 110 f. 2; BACK. & BAKH. *f.* Fl. Java 2 (1965) 544. — *S. indicum* LINNÉ, Sp. Pl. (1753) 634; BACK. Fl. Mal. I, 4 (1951) 217.
Note. Sofar the first to combine these two names was GRAHAM, Cat. Pl. Bombay (1839) 126; he chose the epithet *orientale*, which must then be followed.

Philydraceae

4: 5*b* *Philydrum lanuginosum* BANKS & SOL. *ex* GAERTN.
Add to Distr.: SE. Borneo (near Bandjermasin, DRANSFIELD, June 1974). A welcome filling of the gap between Papua and Malaya.

Pittosporaceae

5: 360 *Citriobatus* CUNNINGHAM *ex* PUTTERLICK. The occurrence of *C. spinescens* (F. v. M.) DRUCE was expected in the Lesser Sunda Islands and in New Guinea. Now it is found indeed in the Lesser Sunda Is. (Flores) and the genus is also found in New Guinea.
Just before vol. 6 of Fl. Mal. was completed, SCHODDE (Austr. J. Bot. Suppl. 3, 1972, 1–60) published a revision of Papuan *Pittosporaceae* in which he recorded also for the first time *Citriobatus* from New Guinea. He distinguished this as a new species: *C. papuanus* SCHODDE, *l.c.* 5, fig. 1. At that time I had no material to check and refrained from commenting. It would differ from *C. spinescens* in the less thorny habit, the thinner smooth pericarp and less seeds (*c.* 20–30), *c.* 3 placentas, longer funicles (up to 6 mm), and slightly larger fruit ($1^3/_4$–$2^1/_2$ cm).
After re-examination of Malesian and Australian material I have come to the conclusion that the differences in sizes of fruit and seeds, the surface of the pericarp, and the degree of spinescence are

variable and cannot count taxonomically. The number of placentas I cannot well count in the fruit; also SCHODDE adds *circiter* before his count.

The only difference with *C. spinescens* I found in the single Papuan specimen available to me (NGF 49455 HENTY & KATIK); it confirms less seeds (but many ovules abortive), a thinner pericarp, and flatter seeds.

For the present I believe the material available (flowers being absent, also in the type K. PAYMANS 433 = CANB 211692) reveals insufficient knowledge of the variability. I wish to postpone a decision of its being really a distinct species until more material becomes available.

Proteaceae

5: 152 *Gevuina* MOLINA.
In a recent study A. C. SMITH (Amer. J. Bot. 62, 1975, 133–147, 51 fig.) disagreed with SLEUMER about the application of the generic name *Gevuina* to the New Guinean species. In his opinion this should be restricted to South America as a monotypic genus. *Kermadecia* would consist of 4 *spp.* endemic to New Caledonia (with an allied monotypic genus *Sleumerodendron*), while the New Guinean species, together with the N. Queensland species, 2 from Fiji and 1 from the New Hebrides, would together form the genus *Bleasdalea* F. v. M.

5: 190 *Heliciopsis* SLEUM.
Recently 3 new *spp.* have been described by KOCHUMMEN from Malaya (Gard. Bull. Sing. 26, 1973, 286–287; Tree Fl. Malaya 2, 1973, 317–320, 2 fig.), bringing the number of species known from Malaya up to 5. Unfortunately there is no key and there are no diagnoses with the descriptions to point out in which way they differ from the species distinguished by SLEUMER in Fl. Mal. and how they should be inserted in the key given there.

Scyphostegiaceae

5: 297 *Scyphostegiaceae.* DING HOU succeeded
6: 967*b* in studying the *germination* (Blumea 20, 1972, 89–92, pl. 1, fig. 1) which is epigeal, and in which the testa and flimsy endosperm are shed off the cotyledons; the first two leaves are opposite, stipulate, ovate, serrate and decussate to the cotyledons.

The haploid number of *chromosomes* is 9 (*cf.* pl. 1) which is close to the base number in Angiosperms: it is far removed from that in *Monimiaceae*, and closer to that in *Flacourtiaceae*.

Thymelaeaceae

4: 352, *Gonystylus* T. & B.
353; To the 28 *spp.* keyed out by SHAW in Fl.
6: 976 Mal. vol. 6 a new one is to be added: **G. eximius** SHAW, and a new variety: **G. affinis** RADLK. *var.* **elegans** SHAW. *Cf.* SHAW, Kew Bull. 28 (1973) 267–268.

6: 15 *Phaleria* JACK.
Since 1960 much new material has been collected in the highlands of New Guinea between 1500 and 2600 m. Among them are some long-flowered specimens. STEVENS (J. Arn. Arb. 55, 1974, 264–268) described three new species and indicated how these would fit into the key of DING HOU (Fl. Mal. I, 6, 1960, 16), including *P. nisidai* KANEH. (which DING HOU also had), preceding this key as follows:

*1. Flowers 8–8½ cm long. Leaves 5¼–9 by 2½–3¼ cm.
P. longituba STEVENS, *l.c.* 265
*1. Flowers less than 4½ cm long. Leaves usually larger.
*2. Anthers included, ± sessile; stigma included.
*3. Inflorescences borne on twigs, 2–5-flowered. Calyx lobes erect.
P. okapensis STEVENS, *l.c.* 265
*3. Inflorescences usually terminal and/or in the axils of the uppermost or adjacent leaves, 8–20-flowered. Calyx lobes reflexed.
*4. Inflorescences 9–20-flowered. Involucral bracts 2, *c.* 4 by 2 mm. Style with short crisped hairs along its entire length.
P. pilistyla STEVENS, *l.c.* 267
*4. Inflorescences 8–12-flowered. Involucral bracts 4¾–10 by 4–6 mm. Style with long hairs only at the base . . **P. nisidai** KANEH.
*2. Anthers and stigma usually exserted, if included then anthers with prominent filaments and floral tube more than 1 cm ⌀ at the throat.
*5. Follow the key by DING HOU, *l.c.*, as in lead 1, from which then *P. nisidai* KANEH. must be deleted.

DING HOU is at the moment not prepared to restudy and check the new species, especially as he has a new collection of Papua with flowers 6 cm long. He wants to postpone his decisions.

Umbelliferae

4: 125; Change 1. *Sanicula europaea* into:
5: 555*b*, **1. Sanicula europaea** L. *ssp.* **elata** (D.
556*a* DON) HULTÉN, Kungl. Svensk. Vet. Ak. Handl. IV, 13. n. 1 (1971) 363, map 138; STEEN. Mt. Flora Java (1972) pl. 54, *in text.* — *S. elata* D. DON, Prod. Fl. Nepal. (1925) 183; SHAN & CONSTANCE, Un. Cal.

Publ. Bot. 25 (1951) 47; BACK. & BAKH. *f.* Fl. Java 2 (1965) 173.

A close study of abundant material revealed that the Malesian taxon does not deserve more than the rank of a subspecies; it ranges from the Himalayas to S. China, Japan, Formosa, and all Malesian islands, but is yet not found in New Guinea.

Violaceae (JACOBS)

7: 197, 198*b* Add after 1. *Hybanthus enneaspermus* (L.) F. v. M. the following variety:

1a. *var.* **verbi-divini** EVERAARTS, *var. nov.*

Differt a specie; *glandula filamenti anterioris breviter cylindrico-cupulari, dense pilosa, petalo anteriori 28–31 mm longo, aurantiaco.*

Typus. SCHMUTZ 3135 (L, holo; PERTH), Lesser Sunda Is., Flores, Kandang.

Shrubby plant 40–175 cm tall. Anterior petal 28–31 mm long, orange. Gland at the anterior filament straight, cylindrical-cup-shaped, mostly about as long as wide, *c.* 0.3 mm wide, densely long-hairy.

Distr. *Malesia*: Lesser Sunda Is. (W. Flores), 6 collections.

Ecol. Shade-loving, in forest-fringes, in distinct dry season, 160–850 m.

Notes. Named in honour of the Societas Verbi Divini, to which several botanically active missionaries belong, namely Fathers KOOY, LOETERS, SCHMUTZ, and VERHEIJEN, see Cyclopaedia Suppl. 2 in Fl. Mal. vol. 8.

Discovered by Father SCHMUTZ who made field observations and photographs, and corresponded with Dr JACOBS about it. At the latter's request Mr A. P. EVERAARTS at the Rijksherbarium dissected and described these specimens and analysed the differences with other *H. enneaspermus*. He also compared it with the Australian species dealt with in Nuytsia 1 (1972) 218–241 by Mrs E. M. BENNETT, Perth, who was consulted. The decision about the rank was taken by Dr M. JACOBS following an overview of the genus at Kew. Thanks are due to Mr P. G. WILSON, Perth, for his speedy cooperation.

INDEX TO SCIENTIFIC PLANT NAMES

compiled by

M. J. VAN STEENIS-KRUSEMAN

Families and higher taxa have been entered under their name.

Names of families which have been revised in volumes 4, 5, 6, and 7 have been entered and are printed in **bold type,** so that as far as this is concerned this index is complete for all preceding volumes as well.

Suprageneric epithets have been entered under the family name to which they belong preceded by the indication of their rank (subfamilies, tribes, *etc.*).

Infrageneric epithets have been entered immediately under the generic name to which they belong preceded by the indication of their rank (subgenera, sections, series, *etc.*).

Infraspecific epithets have been entered under the specific name to which they belong preceded by the indication of their rank (subspecies, variety, forma, *etc.*).

New names and *new combinations* have been printed in **bold type,** *synonyms* in *italics.*

'*Map*' printed behind a page number denotes that a map of the concerned taxon is present on that page.

An *asterisk* behind a page number denotes the presence of a figure of the concerned taxon.

Page numbers in **bold type** denote main treatment.

Some minor printing errors in plant names have been corrected.

Of synonyms with a double authority, the latter has not always been cited in full. The full authority can easily be derived from the text.

FLORA MALESIANA

under the Auspices of
Lembaga Biologi Nasional (Botanic Gardens of Indonesia), Bogor, Indonesia,
and the Rijksherbarium, Leyden, Holland,
executed by Foundation Flora Malesiana

Scientific Communications
concerning the Flora Malesiana should be addressed to
the General Editor, Dr. C. G. G. J. VAN STEENIS

SUBSCRIPTION REQUESTS AND RELATED CORRESPONDENCE
SHOULD BE DIRECTED EXCLUSIVELY TO
NOORDHOFF INTERNATIONAL PUBLISHING
P.O. Box 26, Leyden, The Netherlands

For sale only - Not for exchange

Series I - Spermatophyta (Flowering Plants)

Volume 1. Cyclopaedia of collectors & collections. 1950. pp. clii + 639
Volume 2. Malesian vegetation (In preparation)
Volume 3. Malesian plant geography (In preparation)
Volume 4. General chapters and revisions. 1948–1954. pp. ccix + 631
Volume 5. Bibliography, specific delimitation & revisions. 1955–1958. pp. cccxlii + 596
Volume 6. Systematic revisions. 6 parts. 1960–1972. pp. 20 + 1023
Volume 7. Systematic revisions. Parts 1–4. 1971–1976. pp. 18 + 876
Volume 8. Cyclopaedia of Collectors, Suppl. 2. Systematic revisions. Part 1

NOORDHOFF INTERNATIONAL PUBLISHING, LEYDEN, THE NETHERLANDS

PRINTED IN THE NETHERLANDS

ISBN 90 286 0615 7